PROCEEDINGS

OF THE

THIRTY-SECOND ANNUAL MEETING

OF THE

FLORIDA STATE HORTICULTURAL SOCIETY

HELD AT

ORLANDO, FLA., MAY 6, 7, 8, 9

1919

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Florida State Horticultural Society

ORGANIZED IN 1888

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Annual Membership, $1.00.
Life Membership, $10.00.

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Address all correspondence and make all remittances to the *Secretary*, at Gainesville, Florida.

CONSTITUTION

ARTICLE 1. This organization shall be known as The Florida State Horticultural Society, and its object shall be the advancement of Horticulture.

ARTICLE 2. Any person may become a member of the Society by subscribing to the Constiution and paying one dollar. Any person may become a Life Member of the Society by subscribing to the Constitution and paying ten dollars.

ARTICLE 3. Its officers shall consist of a President, three Vice-Presidents, Secretary, Treasurer, and Executive Committee of three, who shall be elected by ballot at each annual meting. After the first election their term of office shall begin on the first day of January following their election.

ARTICLE 4. The regular annual meeting of this Society shall be held on the second Tuesday in April, except when otherwise ordered by the Executive Committee.

ARTICLE 5. The duties of the President, Vice-President, Secretary and Treasurer shall be such as usually devolve on those officers. The President, Secretary and Treasurer shall be ex-officio members of the Executive Committee.

ARTICLE 6. The Executive Committee shall have authority to act for the Society between annual meetings.

ARTICLE 7. The Constitution may be amended by a vote of two-thirds of the members present.

BY-LAWS

1. The Society year shall be co-extensive with the calendar year, and the annual dues of members shall be one dollar.

2. All bills authorized by the Society or its Executive Committee, for its legitimate expenses, shall be paid by the Secretary's draft on the Treasurer, O. K 'd by the President.

3. The meetings of the Society shall be devoted only to Horticultural topics, from scientific and practical standpoints, and the Presiding Officer shall rule out of order all motions, resolutions and discussions tending to commit the Society to partisan politics or mercantile ventures.

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American Agricultural & Chemical Co., Burdette Loomis, Jr., Mgr., Ft. Pierce.
Amman, John, Orlando.
Amsden, E. W., Ormond Beach.
Anderson, A. V., Avon Park.
Anderson, Frank Kay, Bartow.
Anderson, Fred, Box 363, Crescent City.
Anderson, F. L., Orlando.
Anderson, John J., Box 72, Apopka.
Anderson, J. P., Haines City.
Anderson, L. B., Box 199, Winter Haven.
Andrewe, Alfred, Lutz.
Archambault, J. T., Ft. Pierce.
Armstrong, W. C., Homosassa.
Arnold, T. J., Oak.
Atha, T. H., Orlando.
Attwood, A. L., Tampa.
Ayrer, Maurice, Ft. Myers.
Aultman, S. B., Kissimmee.

Baillie, Wm. J. Jr., Elfers.
Bailey, M. H., Sanibel.
Ballentine, F. S., Ft. Myers.
Ballough, W. E., Daytona.
Barber, L. S., Tallahassee.
Barker, Geo. S., Elfers.
Barnes, C. W., Winter Haven.
Barnes, G. W., Moore Haven.
Barnes, T. J., Bonita Springs.
Barrett, J. H. D., Tampa.
Bartholmew, C. E., 407 Osceola, Orlando.
Baskin, J. D., Clearwater.
Bass, M. M., Winter Haven.
Bassett, E. G., Salerna.
Bartlett, Wright, Ft. Ogden.
Bayless, C. W., Grand Island.
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Bernenderfer, Chas., White City.
Berry, C. M., Sanford.
Bettler, J. E., Rockledge.
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Binney, Edwin, Viking, St. Lucie Co.
Birley, H. C., Lake City.
Birno, Edw. M., P. O. Box 846, Orlando.
Bishop, G. D., care Crown Paper Co., Sanford.
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Blanchard, A., Lake Wales.
Blanchard, Ross C., Maitland.
Blanton, E. P., Valrico.
Bledsoe, B. B., Winter Park.
Bobo, Walter, Gifford.
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Bonynge, Edw. W., Tangerine.
Boomer, Mrs. L. M., Estero.
Booth, Leland, Safety Harbor.
Boring, John, Ft. Myers.
Borland, H. L., Ocala.
Bosanquet, Louis P., Fruitland Park.
Bostrom, C. G., Ormond Beach.
Bosse, R. F., Wauchula.
Bostrom, J. A., Ormond Beach.
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Boyd, E. M., Eagle Lake.
Boyd, Harold J., Clermont.
Boyd, James H., Clermont.
Boyd, R. H., DeLand.
Boyd, W. Lacy, Bartow.
Boydsen, D. W., Lake Worth.
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Bradburg, C. O., Winter Haven.
Bradford, W. A., Lakeland.
Bradshaw, J. U., Orlando.
Branch, W. S., Orlando.
Branham, A. G., Orlando.
Brannock, Geo. P., Daytona.
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Brown, Vet L., Bartow.
Brown, Mrs. Vet. L., Bartow.
Browne, C. E., Lucerne Park.
Bruce, G. Duncan, Winter Haven.
Bruen, Geo. H., Georgiana.
Bruyiere, J., Avon Park.
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Burg, Chas., Eagle Lake.
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Burleigh, E. S., Tavares.
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Butler, Thos., Winter Haven.
Buttler, Howard V., Lake Alfred.
Buttler, Mrs. H. V., Lake Alfred.
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Byrne, E. J., care The Bellview, Bellaire.
Bystra, Dr. H. G., Brooksville.

Caldwell, H. W., Winter Park.
Caldwell, S. W., Lake Wales.
Cameron, A. N., Weirsdale.
Cameron, D. F., Leesburg.
Campbell, A. E., Melbourne.
Campbell, C. M., Winter Park.
Campbell, J. O., P. O. Box D, Melbourne.
Campbell, Peter M., Estero.
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Campbell, W. B., Crescent City.
Campbell, W. E., Seminole.
Carleton, Geo. L., R. F. D., Citra.
Carlmel, Frank, care E. Bean & Son, Jacksonville.
Carson Brothers, Frostproof.
Carlton, J. H., Zolfo.
Carmen Grape Company, (F. J. Zimmerman), Tarpon Springs.
Carn, B. O., Winter Haven.
Carnes, W. W., Lock Box O, Bradentown.
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Carter, Jasper C., Dade City.
Castle, A. C., Perrine.
Chaffin, J., Gainesville.
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Clark, Mrs. H. A., Thonotosassa.
Clark, J. D., Bartow.
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Cogswell, J. H., Maitland.
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Coit, D. G., care Cummer Lunber Co., Jacksonville.
Compton, J. A., Clermont.
Conant, E. E., Bartow.
Condry, P. W., Cocoanut Grove.
Conklin, E. P., Lotus.
Conkling, R. A., Palm Beach.
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Conner, F. Loy, Route 2, Box 35, Bartow.
Conner, H. C., Bartow.
Conner, W. H., Route 2, Box 34, Bartow.
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Constantine, John, R. F. D. 2, Palmetto.
Consumers Lumber & Veneer Co., (A. C. Starbin, Mgr.), Apopka.
Converse, W. H., Leesburg.
Cooley, Maj. W. W., Lantana.
Coolidge, J. W., 10 Mile Creek, Ft. Pierce.
Cooper, H. C., Osceola Fert Co., Jacksonville.
Cornell, H. E., Winter Haven.
Cotton, Richard T., Box 259, Orlando.
Coup, Albert A., Box 209, Punta Gorda.
Cox, E. J., R. F. D. 1, Maitland.
Crafton, Bernard, Malabar.
Crafton, H. R., Malabar.
Crafts, B. R., Lantana.
Cranshaw, C. J., DeLand.
Craver, J. C., Sutherland.
Crisp, Frank W., care Wilson & Toomer Fert. Co., Jacksonville.
Crisp, Thomas, Sarasota.
Crisp, T. H., Box 328, Fidelity Farms, Sarasota.
Cromer, H. A., (Hillsboro Co.), Riverview.
Culver, A. L., Boynton.
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Curry, Howard, Tampa.

Dade, Lawrence T., Ft. Pierce.
Dade, R. H. F., Orlando.
Daetwyler, W. J., Orlando.
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Davis, G. E., Lakeland.
Davis, J. R., Punta Rassa.
Davis, Wm. C., Winter Haven.
Davis, W. M., Orlando.
Davis, W. W., 21st Ave and Euclid Blvd., St. Petersburg.
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DeBusk, E. F., Orlando.
Deckerman, Mrs. Elford, Mt. Dora.
Deering Properties, Charles, Buena Vista.
Delamater, Paul A., Winter Haven.
DeLand, John I., Box 7, Palm City.
Delavan Nursery, West Palm Beach.
Denison, U. A., Winter Haven.
Derby, John H., Rockledge.
Dewey, A. F., Punta Gorda.
DeWitt, W. S., Orlando.
Dickinson, Alfred, Bonita Springs.
Dickinson, C. P., Orlando.
Dickson, H. H., Orlando.
Dieterich, H. G., Sanford.
Dirr, Chas. F., Palm City.
Dobson, Edward, Dade City.
Dodge, Jas. E., Wabasso.
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Donnelly, J. B., Palm Beach.
Donnelly, Thos., Indianola.
Doring, R. L., Bowling Green.
Dorn, Robert W., Larkins.
Dorn, H. W., Larkins.
Dorn, James, Miami.
Dorner, Geo., Boca Grande.
Douet, G., Astatula.
Dovell, M. O., Orlando.
Drake, Frank, Mt. Dora.
Drake, Francis, Hamilton Heath, Tampa.
Drake, Mrs. Francis, Hamilton Heath, Tampa.
Drake, T. P., Yalaha.
Dravo, John S., 10 Mile Creek, Ft. Pierce.
Drew, Mrs. W. L., Eagle Lake.
Duncan, R. W. A., Frostproof.
Dunham, Geo., Ft. Myers.
Dunne, Jesse H., San Antonio.
Durrance, S. P., Avon Park.
Duzey, J. C., Palmdale.

Eberhardt, W. F., Mt. Dora.
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Edwards, Wm., Zellwood.
Eikenberry, H. D., Arcadia.
Ellis, Miss L. C., Orlando.
Ellis. R. H., Orlando.
English, Alex., Winter Park.
English, S. H., Alva.
Ennis, A. D., Maitland.
Erck, G. H., Leesburg.
Ermens, Frank, Elfers.
Etheredge, E. J., DeSoto City.
Evans, Marthenon, Winter Haven.
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Farley, J. F., Malabar.
Fellsmere Company, Fellsmere.
Finlay, Mrs. Isabelle, Orange Center.
Firth, Walter, Box 84, Loughman.
Fishback, D. E., Orlando.
Fitch, Samuel H., Homestead.
Fitts, Mrs. W. A. Jr., Sanford.
Fitzgerald, J. E., Orlando.

Flemings, H., Kissimmee.
Fletcher, F. W., Orlando.
Florida Grower Publishing Co., Tampa.
Flowers, W. H., Eagle Lake.
Floyd, Bayard F., Gainesville.
Floyd, Mrs. Bayard F., Gainesville.
Floyd, C. W., care San Carlos Hotel, Miami.
Floyd, W. L., Gainesville.
Fluke, Thos. J., New Port Richey.
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Foster & Foster, Inc., West Palm Beach.
Fowler, H. C., Almyra Groves, Winter Garden.
Frank, C. P., Ft Myers.
Freeman, W. D., Palm Beach.
Freer, J. D., Lakeland.
Fripp, E. P., Miami.
Fritch, E. D., Earman.
Fuchs, Fritz, R. F. D. 1., Homestead.
Funk, H. L., Orlando.

Gable, P. K., Merritt.
Gaines, Geo. T., Jensen.
Gainey, Norbert, Lakeland.
Gardner, F. C., Lake Alfred.
Gardner, Mrs. F. C., Lake Alfred.
Gardner, J. H., Route 1, Vero.
Garnett, A. W., Hypoloxo.
Garnett, L., Orlando.
Garrard, Dr. J. A., Bartow.
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Garrison, G. P., Homeland.
Garry Brothers, Ft. Myers.
Gaston, W. S., R. F. D. 1, St. Petersburg.
Geier, Agnes T., Windermere.
Geier, Wm. G., Windermere
Geiger, H Louis, Edgewood, R. R. "A," Miami.
Getsee, Joe, Citra.
Gibson, A. P., Clermont.
Giles, Jas. L., Orlando.
Gilliam, A. F., Clarcona.
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Gist, J. R., Gainesville.
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Gocia, H. G., Bee Ridge.
Godden, Chas. E., Lake Worth.
Goldberg, E. R., R. F. D., Homestead.
Gomme, Wm., Bartow.
Goodrich, C. W., Orlando.
Goodrich, Chas., St. Cloud.
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Graham & Shriver Company, Ft. Myers.
Grant, A. J., Dunedin.
Grant, R. S. S., Indianola.
Green, G. F., Fellsmere.
Griffin, S. S., Orlando.
Griffing & Co., C. M., Macclenny.
Grosse, Miss Elizabeth F., Orlando.
Grosse, O. R., Merritt.
Grossenbacher, J. G., Apopka.
Grossenbacher, Mrs. J. G., Plymouth.
Grantham, Benjamin, R. F. D., Citra.
Gulf Fertilizer Co., Citizens Bk. Bldg., Tampa.
Gumphrect, H. G., Box 126, Manatee.
Gurney, L. H., Merritt.
Gustafson, E. G., Ft. Pierce.

Hainlin, Neal E., Clermont.
Hakes, L. A., Winter Park.
Hale, Chas. P., Crescent City.
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Hall, W. Harvey, Yalaha.
Hallam & Co., W. F., Lakeland.
Hamburg, A. B., Lake Wales.
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Hamilton, John, Kissimmee Park.
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Hamm, H. O., care W. A. Merryday Co., Palatka.
Hamm, W. T., Palatka.
Hammond, J. E., Tavares.
Hand, Carey, Orlando.
Hand, Wm. E., 106 W. Magnolia, Lakeland.
Hanna, J. C., Lutz.
Hannah, Dr. A. J., Umatilla.
Hansen, James, Winter Haven.
Harbrecht, L. C., Jensen.
Harding, E. E., Balm.
Harmbargar, John, Fellsmere.
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Harrington, C. W., Winter Haven.
Harrington, Mrs. C. W., Winter Haven.
Harrington, E. W., Winter Haven.
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Harris, W. J., DeLand.
Harrison, F. E., Ft. Myers.
Haselton, Carl, Osprey.
Hasson, H., care Armour Fert. Co., Jacksonville.
Hatton, T. T., Bartow.
Haynes, Abbott, care Mrs. Wm. Roxby, Audubon.
Haynes, A. C., DeLand.
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Hennessey, A. L., Fellsmere.
Henschen, R., Ft. Myers.
Hentz, Mrs. W. B., Winter Haven.
Hentzelman, Fritz, Bagdad.
Herbst, Emil, R. F. D., Ft. Pierce.
Hewitt, P. A., Bradentown.
Hewke, T. S., Winter Park.
Hiatt, S. W., Gainesville.
Hicks, T. B., Sebastian.
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Hite, C. F., Bokeelia.
Hoenig, M. J., West Palm Beach.

Holescheiter, J. G., New Port Richey.
Holmes, Geo. W. (M. D.), Merritt.
Holworthy, A. J., Lakeland.
Hooker, J. N., Bartow.
Hopper, R. W. Co., Mont Verde.
Horton, C. E., Winter Haven.
Horton, E. S., Winter Haven.
Hosford, Ed. L., Sewalls Point.
Howard, C. E., Orlando.
Howard, J. B., Lakeland.
Howell, D. Henderson, Vero.
Howell, J. L., Dunedin.
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Howes, W. L., Box 1156, Jacksonville.
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Hubbard, Mrs. E. S., Federal Point.
Hubbard, N. C., Lockhart.
Huddleston, J. H., Geneva.
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Hull, J. C., Orlando.
Hull, S. B., Oakland.
Hullmann, Walter, St. Petersburg.
Hume, E. G., Glen St. Mary.
Hume, H. Harold, Glen St. Mary.
Hume, Mrs. H. Harold, Glen St. Mary.
Humphrys, A. S., Indianola.
Hunt, Chas. M., Gainesville.
Hunt, W. W., care Cummer Lumber Co., Jacksonville.
Hutchins & Company, Orlando.
Hutchinson, E., Davenport.
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Ingraham, J. E., St. Augustine.
Inman, S. C., Winter Haven.

Jackson, Arthur, Shiloh.
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James, Geo. O., care Florida Grower, Tampa.
Javens, M. Marcellus, Mt. Dora.
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Johnson, O. F., Piedmont.
Johnson, S., Orlando.
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Jones, J. C., Vero.
Jones, J. W., Winter Garden.
Jones, R. F., Lake Hamilton.
Judy, G W., Carew Ave., Tampa.

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Keck, Irving, Bowling Green.
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Kern, John F., Jupiter.
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Kilgore, Forest, Orlando.
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Kineman, C. B., Titusville.
King, Wm., Avon Park.
King, W. A., Panasoffkee.
Kirkland, L. P., Winter Haven.
Kirkpatrick, John, Ft. Pierce.
Klemm, Mrs. A. R., Winter Haven.
Klemm, A. Richard, Winter Haven.
Klemm, Arthur R., Winter Haven.
Klingsick, Edward, Vero.
Knight, Joe, Elfers.
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Knight, Mrs. R. J., Safety Harbor.
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Knox, L. B., Bulow.
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Korndoerfer, W. A., Elfers.
Kraemer, H. M., Ft. Myers.
Krome, Mrs. W. J., Homestead.
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Krueger, A. R., Stuart.
Kuhl, Geo. B., Oak Hill.

Lafon, N., Paisley.
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Lake Garfield Nurseries, Bartow.
Lake, J. W., Frostproof.
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Larson, J. M., Piedmont.
Larson, Jonas, Piedmont.
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Lathers, M. F., Dade City.
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Lawrence, C. W., Frostproof.

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Leach, Robert, Oakhurst.
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Lee, Thomas G., Box 515, Orlando.
Lenfest, R. E., DeLand.
LeJeune, Chas., Miami.
Lennard, B. E., care A. C. L. Ry., Jacksonville.
Lent, Victor, Sorrento.
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Link, Alfred, Orlando.
Link, W. R., Orlando.
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Lytle, R. L., Weirsdale.

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McBride, W. A., Viking.
McBride, John, Ft. Myers.
McCabe, Margaret M., Winter Haven.
McCabe, P., San Antonio.
McCall, W. W., Lake Alfred.
McClanaham, S. F., Groveland.
McClure, Tom W., Fellsmere.
McConnell, Dr. Thomas H., Orlando.
McCord, F. E., Palm City.
McCulloch, John, Maitland.
McElroy, Dr. Sylvan, Orlando.
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McMullen, B. L., R. F. D., Clearwater.
McQuarrie, C. K., Gainesville.
McQuarrie, D. R., Bee Ridge.
McRee, J. N., Palmetto.
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Mann, W. E., Palmetto.
Mann, W. W., Winter Haven.
Mapp, Edward, Stuart.
Markle, G. W., Winter Haven.
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Marsh, Geo. S. Jr., 502 East Washington St, Orlando.
Marsh, J. F., Ocala.
Marshall, B. B., Winter Haven.
Marshall, Galen G., Winter Haven.
Martin, A. O., Apopka.
Martin, Geo., Drawer B., Sebastian.
Martin, H. E., Largo.
Martin, L. A., Winter Haven.
Martin, William John, Orange City.
Masters, W. G., Ft. Myers.
Matheson, Hugh M., Cocoanut Grove.
Mathews, W. R., Leesburg.
Mathis, W. B., Glen St. Mary.
Maxson, C. C., Orlando.
May, J. S., DeLand.
Mead, Theo. L., Oviedo.
Meffert, J. M., Ocala.
Melton, William, West Palm Beach.
Melvin, D. M., Box 621, Winter Haven.
Mendall, Mrs. M. R., Hawks Park.
Menzel, Wm., Box 157, Boynton.
Meres, Amelia P., Tarpon Springs.
Merrell, Herman, St. Petersburg.
Merrill, John E., Plymouth.
Michael, A. B., Wabasso.
Miles, Franklin P., Ft. Myers.
Mill, John P., Leesburg.
Miller, Chas. A., DeLand.
Miller, C. H., Goulds.
Miller, E. Lee, Orlando.
Miller, Geo. A., P. O. Box 352, New St. Augustine.
Miller, J. W., Leesburg.
Miller, M. M., Sebastian.
Miller, W. F., Valrico.
Mills, Mrs. Mary P., P. O. Box 86, Plant City.
Mink, T. M., Winter Garden.
Minnicht, C. L., Lake Gem.
Minor, T. J., Ocoee.
Mitchell, J. F., Box W., Titusville.
Mitchell, J. W., Orlando.
Mitchell, Mrs. M. G., Bartow.
Mitchell, M. R., Avon Park.
Mooney, Chas N., Cocoa.

Moorhead, Mrs. Caroline, Ocala.
Moore, Jno. L., Haines City.
Moore, J. Lawrence, R. F. D. 5, Box 178, Tampa.
Morgan, E. H., Ft. Ogden.
Morgan, Jessie T., 187 R. F. D., Lake View Ave., St. Petersburg.
Moreman, M. S., Switzerland.
Morley, John, Lake Alfred.
Morrey, E. B., Apopka.
Morton, Mrs. Caroline P., Box 704, Orlando.
Morton, Miss Gertrude P., Box 704, Orlando.
Morton, W. D., Clarcona.
Moseley, J. E., Gotha.
Moss, F. E., Route B, Box 105, Lakeland.
Moses, Wallace R., Box A 11, West Palm Beach.
Mosses, Wallace R., Ft. Pierce.
Moznette, G. F., Box 1134, Miami.
Muhse, Albert C., Bradentown.
Mulrennan, J. P., Sidney.
Munson, F. W., Georgiana.
Murchison, J. C., 17 Jefferson St., Jacksonville.

Naberhuis, H. A., 115 2nd St., Miami.
Nanney, W. C., Frostproof.
Nelson, Steen, Oviedo.
Nevins, Groves, Merritt.
Newell, Wilmon, Gainesville.
Nichols, A. C., R. F. D., Clearwater.
Nocatee Crate Company, Nocatee.
Nordmann, Fred, New Smyrna.
Norfleet, J. H., Newberry.
Nutt, W. E., Sutherland.
Nye, Jay, Orlando.
Nyman, J. A., Sharpes.

O'Byrne, F. M., Gainesville.
Ocala Manufacturing Co., Ocala.
Oesterle, Chas., Clearwater.
Oglesby, Ren., Bartow.
O'Hara, A. B., Rockledge.
Ohmer, C. J., West Palm Beach.
O'Kelly, E. B., 303 West Bldg., Jacksonville.
Olds, M. J., Marco.
O'Neal, Mrs. Julia, 239 W. Forsyth St., Jacksonville.
O'Neal, Mrs. J. G., 210 W. Monroe St., Jacksonville.
O'Neal, W. R., Orlando.
Opitz, E. W., Owanita, Lee County.
Orchard, Paul W., St. Augustine.
Orlando Typewriter & Supply Co., care R. J. Shilling, Orlando.
Orr, Grant, Areadia.
Orr, Harry F., San Blas.
Osteen, J. W., Altamonte Springs.
Ott, John, Vero.
Overstreet, M. O., Orlando.

Palmer, J. C., Windermere.
Pancoast, B. K., Seffner.
Parkinson, Edward, Alva.
Pattillo, C. J., Oak Hill.
Pattillo, J. E., Oak Hill.
Pattillo, Miss Edna, Oak Hill.
Patton, B. A., Loughman.
Pearce, Eugene L., Clearwater.
Pearce, F. M., Cates City.
Pelican Groves (Hy Anner, Mgr.), Georgiana.
Pepper, J. L., Sec. Chamber of Commerce, Daytona.
Perkins, A. E. Jr., Taft.
Perrin, R. G., R. F. D. 1., Winter Haven.
Perkins, J. W., DeLand.
Peterkin, Geo. W., Crooked Lake.
Pfeifer, James L, Orlando.
Phillips, Dr. P., Orlando.
Phillips, I. W., Orlando.
Phillips, John, East Lake.
Philpot, R. O., Haines City.
Phipps, H. F., Ft. Myers.
Pickard, A. F., Lakeland.
Pierce, Mrs. Mary E., Georgiana.
Pinkney, Samuel, Apopka.
Pixton, J. W., Iona, Lee County.
Player, Harry, P. O Box 752, Tampa.
Poole, S. F., Lake Alfred.
Pope, R. D., Winter Haven.
Porcher, A. G., Cocoa.
Prange, F. C., Vero.
Prescott, J. D., Orlando.
Preston, Miss Moselle, Bartow.
Preston, Walter L., 1001 Citizens Bank Bldg., Tampa.
Prevatt, A. B., Seville.
Pritchett, H. E., Lakeland.
Provost, Chas. D., Georgiana.
Pruden, Alfred J., Winter Haven.
Pugsley, Chas., Winter Haven.
Pullen, G. E., P. O. Box H, Palmetto.

Ralb, Albert G., R. F. D., Homestead.
Ragin, R. H., Oak Hill.
Rahn, Wm. J., Georgiana.
Raulerson, C. A., Geneva.
Ray, Alexander, City Hall, Jacksonville.
Raymond, W. W., Owanita.
Reasoner, E. N., Oneco.
Reinsch Bruno, Ft. Lauderdale.
Resch, J. W., Paisley.
Rex, J. W., 10 East Livingston St., Orlando.
Reynolds, A. J., care The Florida Press, Tampa.
Reynolds, Albert T., Box 294, Daytona.
Reynolds, M. L., Ocala.
Rhodes, J. F., Ritta.
Rhodes, L. M., 417 St. James Bldg., Jacksonville.
Ricker, R. C., Bradentown.
Ringdahl, G., White City.
Ringhansen, Edward, Route 1. Box 16, Orlando.
Robarts, A., Route A, Box 6, Dade City.
Roberts, Norton, Box 211, Tampa.
Robertson, Paul F., R. F. D., B, Lakeland.
Robertson, W. H., 335 Ridgewood Ave., Orlando.

Robinson, G. A., Lake Wales.
Robinson, Karl, Montverde.
Robinson, T. Ralph, Box 7, Terra Ceia.
Robinson, Williard H., P. O. Box 137, Lake Helen.
Rogers, Chas., Orlando.
Roller, F. O., Micco.
Ronald, T. Grotjson, Cocoa.
Rose, Capt. R. E., Tallahassee.
Rose, Mrs. R. E., Tallahassee.
Ross, Dr. J. H., Winter Haven.
Ross, Mrs. J. H., Winter Haven.
Rothera, H. S., New Port Richey.
Rummell, Richard S. Jr., Courtenay.
Royall, B. L., Sebastian.

Sadler, J. H., Box 82, Oakland.
Sadler, O. W., Mt. Dora.
Sampson, F. G., Boardman.
Sampson, Mrs. F. G., Boardman.
Sanborn, Dr. N. W., Gainesville.
Savage, Frank W., Eustis.
Savean, A. L., Altamonte Springs.
Sawyer, R. J., Bee Ridge.
Schabinger, J. J., Box 472, Delray.
Schermerborn, Chas. F., Oak Knoll.
Schlobig, John, Sebring.
Schnabel, John, Glen St. Mary.
Schnarr, J. S., Orlando.
Schober, Dr. W. B., Cocoanut Grove.
Schroeder, Erich, Box 175, Jensen.
Schubert, W. J., care Armour Fert. Wks., Jacksonville.
Schubert, Mrs. W. J., care Armour Fert. Wks., Jacksonville.
Schuler, H. A., P. O. Box 1156, Jacksonville.
Schumacher, A. J., Fort Worth.
Schumacher, E., Sharpes.
Schumacher, H. E., R. F. D. 1, Homestead.
Schuman, Albert, Vero.
Scott, David, P. O. Box 357, Arcadia.
Scott, J. B., Winter Haven.
Scott, L. W., P. O. Box R. R. 1, Tallahassee.
Sebring, H. O., Sebring.
Sensabaugh, W. M., Box 4, Winter Haven.
Sessions, D. L., Box 991, Orlando.
Sessons, Wm. A., Arcadia.
Sexton, W. E., Vero.
Seydel, J. A., Orange City.
Shamburger, P. M., Pine Castle.
Shaw, Miss Eleanor, Mt. Dora.
Shaw, E. T., Ft. Myers.
Shaw, W. P., R. R., B, Box 92, Dade City.
Sheffield, C. P., Florida City.
Shepherd, S. P., Winter Garden.
Sherbakoff, C. D., Gainesville.
Sherman, Charles D., Avon Par
Sherman, E. B., S. Lake Weir.
Shipley, W. J., Box 112, Trilby.
Shooter, C. C., Earleton.
Shultz, W. H., Winter Park.
Shutt, O. W., Thonotasassa.
Siedenburg, A. E., Box 17, Oneco.
Sigler, Geo. T., Loughman.
Simonds, Edward, Miami.
Simms, Capt. B. M., Orlando.
Simpson, James, Mt. Dora.
Sims, Geo. R., New Port Richey.
Skelly, F. L., Orlando.
Skiff, Dr. Ernest Gage, Sebring.
Skinner, B. C., Dunedin.
Skinner, Miss Elizabeth, Dunedin.
Skinner, F. L., Dunedin.
Skinner, L. B., Dunedin.
Skinner, Mrs. Mary E., Dunedin.
Skinner, R. E., Dunedin.
Sloan, G. D., Lakeland.
Smith, A. F., Elfers.
Smith, A. H., Orlando.
Smith, C. D., Mt. Dora.
Smith, Frank A., Orlando.
Smith, Gould, Naples, Lee County.
Smith, G. T., Winter Garden.
Smith, H. T., P. O. Box 328, Lakeland.
Smith, J. A., Lake Alfred.
Smith, Jeremiah B., Box 30, Orlando.
Smith, L. C., 113 Ernestine St., Orlando.
Smith, Lisle W., Haines City.
Smith, O. E., Wauchula.
Snively, J. A., Winter Haven.
Soar, Ira E., Dade City.
Snook, T. B., Wiersdale.
Southern Fertilizer Co., Orlando.
Sperry, C. A., Box 205-B, R. F. D. 2, Tampa.
Sperry, W. D., Box 362, Lakeland.
Spiller, W. A., Sharpes.
Staebner, F. E., Gainesville.
Stafford, A. H., Windermere.
Staley, C. P., Ft. Myers.
Stall, B. E., Route 1, Tampa.
Stemke, F. W., Route 1, Box 41-A, Orlando.
Stanford, G. P., R. R., A., Arcadia.
Stanifield, Chas., 360 West 10th St., Jacksonville.
Stebbins, Henry H., Thonotasassa.
Stirling, Frank, Gainesville.
Stern, S. H., 1412 Nance Ave., Tampa.
Stevens, H. B., Box 303, DeLand.
Stevens, H. E., Gainesville.
Stevenson, R. D., Elfers.
Stewart, C. E. Jr., care Fla. Citrus Exchange, Tampa.
Stewart, E. C., Bartow.
Stewart, Ruth L., 832 South Blvd., Tampa.
Stillman, Fred A., Daytona.
Stockett, A. W., Bee Ridge.
Strait, O. W., Thonotasassa.
Straub, H. L., Weirsdale.
Street, A. W., Gainesville.
Stringfellow, W. M., Pineland.
Stubbs, C. J., Ft. Myers.
Sullens, J. M., Orlando.
Sullivan, O. D., Box 73, Woodrow.
Swan, J. Lee, Lakeland.

Swanke, Geo., Lake Wales.
Swanson, A. L., West Palm Beach.
Swartsel, Howard B., Elfers.
Swartsel, J. F., Elfers.
Swartsel, N. M., Elfers.
Swift, Dr. M. B., Orlando.
Swindle, J. C., Lakeland.
Swope, O. P., Oviedo.
Symonds, A. D., Route 1, Orlando.

Taber, G. L. Jr., Glen St. Mary.
Tabor, Mrs. G. L., Glen St. Mary.
Talbott, W. O., Goulds.
Tatom, Dr. F. L., DeFuniak Springs.
Taylor, F. DeWitt, Oak Hill.
Taylor, F. W., Box 13, DeLand.
Taylor, Jas. A., Oak Hill.
Taylor, Mrs. Wm. H., Box 6, Rood.
Taylor, W. O., Ocala.
Taylor, W. S., R. F. D. 2, Ybor City.
Teat, J. A., Winter Park.
Temple, Mrs. W. C., 4 Chase Ave., Winter Park.
Tenney, F. F., Federal Point.
Tenney, Mrs. F. F., Federal Point.
Terwilligar, A. C., Titusville.
Thollander, John, Piedmont.
Thomas Advertising Service, Jacksonville.
Thomas, Jefferson, care Thomas Adv. Service, Jacksonville.
Thompson, C. H., R. F. D. 1, Winter Haven.
Thompson, Mrs. C. H., R. F. D. 1, Winter Haven.
Thompson, Dr J. L., Frostproof.
Thompson, James, Orlando.
Thompson, Ralph P., R. F. D. 1, Winter Haven.
Thulberry, A. C., Lake Wales.
Thulberry, H. A., Lake Wales.
Thayer, G. E., Crooked Lake.
Thys, Leon, Box 26, Elfers.
Tibbetts, Geo. W., Apopka.
Ticknor, H. J., Zephyrhills.
Tilden, L. W., Winter Garden.
Tillinghast, B. F., Crescent City.
Tillinghast, Mrs. B. F., Crescent City.
Tillinghast, Miss Helen, Crescent City.
Tipper, E. R., R. R., 1, Box 19, Lutz.
Tippin, Geo. T., Vero.
Tourtellatte, L. E., Limona.
Townsend, J. L., R. 1, Box 30, Wauchula.
Travis, M. J., Box 74, Vero.
Tresher, Geo., 503 West Central, Orlando.
Truskett, E. E., Montverde.
Tucker, Mrs. H. S., Merritt.
Tuller, R. J., Leesburg.
Tussey, H. H., Alva.
Tuttle, W. E., 212 Hogan St., Jacksonville.
Tyron, A. C., Box 1411, Pensacola.
Tysen, J. R., 1844 Pearl St., Jacksonville.

Urban, O. C. G., Homestead.

Viertel, Max E., Winter Haven.
Vickers, Geo. F., Sebastian.
Vick, J. H., Box 594, Orlando.
Vaugan, Horace A., Jensen.
Vaughn, F. B., Box 42, Leesburg.
Varn, M. L., Eagle Lake.
Van Roy, Frederick, Crystal River.

Waddell, Edwin A., 235 12th St., Miami.
Waits, B. F., Leesburg.
Wakelin, G. M., P. O. Box 53, Tavares.
Wakelin, Mrs. G. M., P. O. Box 53, Tavares.
Walcott, A. D., Auburndale.
Waldron, Max, Route A., Lakeland.
Waldron, D. W., Ormond.
Walker, C. H., Bartow.
Walker, G. P., Clearwater.
Walker, S. W., Tampa.
Walker, J. E., Lakeland.
Walsh, C. A., Davie.
Walsingham, J. A., Largo.
Ward, C. W., Box 112, Winter Park.
Ward, H. A., Winter Park.
Ward, J. Walker, P. O. Box 423, Orlando.
Ward, Samuel, Haines City.
Warden, C. K., Kissimmee Park.
Warner, A. N., Largo.
Warner, L. R., Key West.
Warner, S. C., East Palatka.
Warnell Lumber & Veneer Co., Plant City.
Warren, Alfred, Ft. Pierce.
Wartmann, E. L., Citra.
Wartmann, H. A., Citra.
Watkins, A. C., Sharpes.
Watkins, S. W., Clearwater.
Watkins, Col. T. J., Orlando.
Watson, J. R., Gainesville.
Watson, P. L., Wuefert.
Weaver, Dr. R. Thor, Kissimmee.
Webster, A. D., DeSoto City.
Wedding, R. T., St. Petersburg.
Wedge, Alexander, Ft. Lauderdale.
Weiland, Chas., Estero.
Weissinger, J. F., care Aripeka Saw Mills, Tampa.
Wells, B. B., City Point.
Wendle, Henry, Gotha.
Werner, Robert, Box 3, Palm Beach.
Wescott, Walter, Orlando.
West, J. A. (M. D.), Winter Haven.
Whaley, M. S., Courtenay.
Whidden, W., Useppa Island.
Whitaker, W. R., Manatee.
White, A. L., Ft. Myers.
Whiteside, F., Box 247, Ft. Lauderdale.
Whitley, R. M., Route D A, 226, Miami.
Whitley, Mrs. R. M., Route D A, 226, Miami.
Whitner, Chas. H., Sanford.
Whittaker, John, Lane Court, St. Petersburg.
Wigfield, Miss Virginia, Box 42, Quay.
Wight, Mrs. S. B., Sanford.

Wightman, L., Box 576, Tampa.
Wilfingham, E. G., Aripeka.
Wilkins, Col. Willis, Orlando.
Willet, A. H., Box 626, Orlando.
Willets, C. O., Orlando.
Williams, J. P., Orlando.
Williams, M. O., Mt. Dora.
Williams, Simon F., 602 Profess. Bldg., Jacksonville.
Williamson & Dennis, Box 1812, Jacksonville.
Wilmott, J. W., Orlando.
Wilmshurst, H. J., Box 84, DeLand.
Wilson, C. H., Clermont.
Wilson, T. J., Box 487, Orlando.
Wilson, W. N., Gainesville.
Wirt, R. D., Crooked Lake.
Wilson, M. C., Weirsdale.
Winchester, E. L., Boynton.
Winston, J. R., Orlando.
Wolfe, R. L., Glen St. Mary.
Woodruff, Hamilton, Box 1154, Jacksonville.
Wordehoff, H. B., Drawer O, Plant City.
Woelffle, E. H., Ritta.
Worthen, S. T., St. Petersburg.
Wright, Edgar A., Editor Florida Grower, Tampa.
Wright, Mrs. Edgar A., 5505 Branch Ave., Tampa.
Wright, R. P., Winter Garden.
Wyman, Dr. W. E. A., Oldsmar.

Yound, O. M., R. R. Box 15, Valrico.
Young, Chas., Bay Shore Blvd., Box 21, Tampa.

Zanger, O. V., Orlando.
Zurn, H. A., Orlando.

1361 members this yr.

THE
FLORIDA STATE
HORTICULTURAL SOCIETY
QUARTERLY

Proceedings of the Thirty-Second Annual Meeting of the Florida State Horticultural Society

The Thirty-second Annual Meeting of the Florida State Horticultural Society opened at Orlando, in the Phillips Theatre, Tuesday evening, May 6, 1919, at 8:30 p. m., with 2nd Vice-President S. F. Poole in the chair. There was general regret at the absence of President Hume, who was in Tallahassee assisting to secure the passage of the Citrus Canker appropriation; but under the able leadership of Mr. Poole and 1st Vice-President L. B. Skinner, who took the chair on Wednesday morning and served during the remainder of the meeting, the audience was soon at ease and the session proved to be a great success.

The attendance at this meeting exceeded that of any previous meeting, reaching nearly six hundred. The total membership for the year, at time of going to press is:

Honorary members	3
Life members	121
Annual members outside State	220
Annual members within State	1029
Total membership	1373

The high marks in membership and attendance were due, very largely, to the enthusiastic help given by Mr. Russell Kay of the Florida Grower, Mr. F. M. C'Byrne of the State Plant Board, and Mr. W. H. Brokaw of Orlando.

Too much praise cannot be given to the Orlando Board of Trade and its Secretary, H. M. Voorhis, who spared neither time nor money in their preparation to entertain the Horticultural Society. Nothing was left undone that might add to the pleasure and comfort of the members of the Society.

This organization is one of which Orlando and Florida may well be proud, and is one that will in time make Orlando the chief city in Florida and possibly the South.

The floral and plant decorations in the Phillips Theatre, prepared by Mrs. Carruthers of Orlando and Mr. Theo. L. Mead of Oviedo, were of much interest and a delight to all. There was an extensive exhibit of gladioli and amaryllis that had been grown in Mr. Mead's own garden. In speaking of them, Mr. Mead

stated: "The site where these plants were grown was once a magnificent orange grove. The grove went into the past about twenty-five years ago, and I found that these plants were adapted to that ground.

"The gladiolus is a plant that grows naturally in dry season, but it is much better to take it up after it has matured. Some few will come up from bulbs left in the ground. The amaryllis, on each side, are not so. They enjoy remaining in the land year after year. Within the last four weeks or so I suppose I have had ten thousand of the amaryllis flowers in bloom at one time, and almost continuously, and those bulbs that produced them are practically the grandchildren and great grandchildren of one single bulb. I have all the different varieties, and there is absolutely an unlimited variety of color, from the deepest crimson to almost pure white. Amaryllis seems amenable to improvement. I have my ideal in this. I hope to produce a pure white one, and one as black as possible. One or two flowers of one has only a thread of scarlet on the edge of each petal. I have already progressed somewhat toward my ideal to make a pure white one.

"In the gladioli I have also my ideals. My ideal is nearly six inches across, and on a stem six feet high; of the pure white, and able to stand Florida sun. If I live long enough, I hope to present this Society with such flowers."

The chief address of the opening session was given by Mr. W. T. Swingle, of the office of Crop Physiology and Breeding Investigations of the United States Department of Agriculture. Mr. Swingle had only recently returned from the Orient, where he had spent more than a year on Government work and in a study of sub-tropical horticulture.

The subject of his address was "Citrus Culture in the Orient." Mr. Swingle showed a number of colored lantern slides illustrating the methods of care of the trees in China and Japan. Perhaps Mr. Swingle's most impressive statement was that citrus canker had made the growing of round oranges practically impossible in the countries where it occurred uncontrolled.

The meeting adjourned on Thursday night, May 8, to meet in Ocala, Florida, in the spring of 1920.

Address of Welcome

Mayor W. R. O'Neal, Orlando.

Mr. Chairman, Ladies and Gentlemen, Fellow Members of the Society:

I bid you a hearty welcome to our city. It was my privilege, a good many years ago, to invite your Society to come, and to come again. Twice, as I recall it, you honored us by your presence. You expressed yourselves as well pleased when you left the first time, and you came again. When you left the second time, my recollection is that you expressed yourselves as well pleased, and you promised that, some time in the future, you would return. You have come, and we are glad to extend a welcome to you at this time.

I am particularly happy in seeing present tonight so many of the good ladies. I presume that all of you know that Orlando is one of the first cities in Florida to extend the right of franchise to the good women (applause), and that just in a few more days they are going to help settle some of the problems of our town. They are going to say as to whether or not we shall expend a large sum of money for the building of streets and other things; and they are going to have quite a voice in it. It is very much to our encouragement that so many of you are here tonight.

It is my privilege to tell you about your Society—when it was organized, how successful it has been and how successful it is going to be. That is always the prerogative of the man who makes the address of welcome. He usually tells you about the things that he does not know and that you do know, but I am not going to do this. I am going to let you, in the hours to come, discuss those things, and to find out how much of progress this Society has made.

From the time of Dudley Adams, one of the pioneers of Orange county, whose trees were never trimmed,—because that was his theory of the thing,—down to this good hour, there have been remarkable changes in the progress of this fair State of ours. And so, as you come to us in the days that are to come, we rejoice in the development of this State.

Not knowing very much about it, I took occasion to look up what it was that I was to talk about. I suppose that you all know what it is, but you know we always refer back to that book that tells us about it and which says: "Horticulture —the cultivation of a garden or orchard; the science," mark you, "the science and art of growing fruits, vegetables, flowers or ornamentals." Science, art, fruit, vegetables. What is a garden? I turn again,

and I find, "A garden is a piece of ground appropriate for the cultivation of herbs, fruits, flowers or vegetables"—hence a rich, well cultivated spot or tract of country. We are going to grow fruits; we are going to grow flowers; we are going to put in science and art; we are going to understand all these things that make of earth a heaven. A man said a few moments ago to me that this was good enough for him; that if he could have a little taste of all these good things that grow in this fair land, it would be a good part of heaven.

We have met difficulties and have overcome them one by one. From the time they told you you could neither milk a cow down here, nor grow potatoes nor peas—from that time up to this good hour, we have been developing the country. And I want to say, in this presence, that the work of this Society—(and I speak in all seriousness and not to be fulsome) the work of this Society has been one of the largest factors in the development of this Southland, from the time of the tin can down to the time of the splendid vegetables we find on our tables today. It has been the work of the men and the women who have put the brain, the power and the energy into the development of the country.

An old Greek idiom has it that "difficulties are things which show what men are." Think of it a moment, "difficulties are the things which show what men are." The difficulties that have come into this Southland—the difficulties that have come into South Florida, are the things that have proven the characters of our people. The fighting spirit that determines success is the characteristic of this country, and that is what has made us. The work which you are doing and the work which you are to do in the days which are to come, to develop this idea, is the thing which we realize the importance of.

I have another prerogative, and that is to tell you all about the place which you are to see. I want to tell you about the roads here, the flowers, the parks, and tell you all about the country. Then I will tell you a funny story andquit; and I will have performed the duties of the man who gives you the address of welcome. I am not going to tell you anything about this part of the country. I want you to go and see for yourselves. I want you to see the roads that lead north, east, south and west—I want you to go to the town of Winter Park to the north, and see the wonderful development there—I want you to see Winter Garden, Oak Hill and that territory—I want you to see the parks that have been made here—the development made by city government and the county commissioners—and then I want you to go into the homes of our people; I want you to get to know us better. If you see a man on the street, in an automobile, hold up your hand and say, "I want to ride," and he will stop and take you in.

I bid you a splendid welcome to this, which we believe to be the fairest city in the State, because the man who does not believe his own house, his own home and his own community, his own State and his own nation is the greatest place on the face of the earth, ought to move out and

go somewhere else; and from the fellow from the Keys to the man from the Perdido river and from Nassau county—go where you will, believe in your town, believe in your State and believe in your country. There never was such a time in all the history of the world, going back where you will, when the spirit of our people has put the life into the work, as it has in the last two or three years.

One of our friends said to me the other day that he was propagating a certain flower, and he told how many years it took to make it. I said, "I never could wait that long," and the reply was, "You are not waiting, you are developing." And now, my people, don't you know that we are developing, we are building a heritage for the children which are to come, in the fairest fields, with the fairest flowers and the fairest fruits that God, in His goodness, has ever put anywhere. And with a hundred and twenty-five millions of people in this country that are to come, while many of us in the sound of my voice are living, with the splendid work which is being done, we have a vista open that is equal to that glorious land of which we are told in Revelations. And as helping us, I bid you welcome to Orlando and its surroundings and its people, recognizing the fact that you are doing the greatest work of any of the people who are developing the State. I thank you.

RESPONSE

C. K. McQuarrie, Gainesville.

Mr. Chairman, Mr. O'Neal, Ladies and Gentlemen:

I have been called upon quite unexpectedly to reply to the address of welcome.

Mr. O'Neal, I thank you very much for your kind words, and on behalf of the Society, I want to thank you most sincerely for the fine address you have given us.

I have been a member of this Society for a great many years. When we look back, we see the Society has had a great many ups and downs. I remember several meetings when conditions looked black, but we have emerged from those days and today we stand on a very high pinnacle. We are today more prosperous than we have ever been in the history of the Society.

There are a great many things I would like to talk about tonight—the past history of this Society—but others will take up some of those things, and I want to tell Mr. O'Neal and some other gentlemen that we have a Society somewhat unique—a Society thirty-two years old—a membership made up of a great many different kinds of people. We have multi-millionaires, we have semi-millionaires, and we have quite a number that expect to be millionaires some of these

days. Then we have among our members men that are engaged in other work besides the production of citrus fruits. We have members in this Society that are engaged in trucking, and some of them make considerable money at that work, and the combination of the citrus and truck, in some cases, helps a man to climb the ladder that leads to the pinnacle, where he can be called a millionaire. We have live stock men, we have men in the hog raising business. We have men that have the pure breed and we have some that have both the pure breed and the thoroughbred. There is the distinction between a pure breed and the thoroughbred. A pure breed is a hog that has something behind it, it can be registered. A thoroughbred is an animal that can run the fastest. We have members engaged in all different lines of work that helps the upbuilding of your State.

We are glad, indeed, to come to your beautiful city. There is only one other city in Florida that I would put before Orlando, and that is my home—Gainesville. We can beat you by two or three thousand population. The man that comes here to spend the winter doesn't come to us in Gainesville. We would be very glad to have him, but somehow he doesn't fit in with us.

Alachua county has the distinction of having more banks than any other county in Florida—sixteen banks in the county. It is one of the wealthiest counties in the State.

We are going to have papers during this week that are going to be very instructive, and I want all your town people and all that are here tonight to be sure and attend our meetings. I thank you.

Lime and Fertilizers

Dr. H. J. Wheeler, Boston, Mass.

Mr. Skinner: I am very sorry, indeed, that Prof. Hume is not here to preside today. Prof. Hume is doing a wonderful work for all the citrus growers of Florida, and we wish him great success. We must pass some resolutions this morning on the citrus canker proposition—some resolutions that will have an effect in Tallahassee, in assisting our committee up there to get this citrus canker bill through the Legislature. You can hardly realize the awful task they have. The slogan of economy is a good one, but there is an economy that wastes, and the economy they are trying to follow in Tallahassee today is too strict, too severe, it cuts too deep. We have spent over a million and a half dollars in fighting citrus canker, and we have almost won out; we have almost struck it down; we have almost banished it from the State. It is a great pity to stop now. We can't stop now, we must go ahead, and we are asking the Legislature for a very small sum to do it. The Legislature has done splendidly in the past, and they mean to do the right thing. It is only up to us to show them that this is the right time, that they may grasp the situation; that they may take hold with us and finish the job. This is a day of finishing things, and I think we should finish the canker and banish it from the State. It is possible to do it; it is almost in sight, and we must carry it through.

The program today starts with Dr. Wheeler.

Dr. Wheeler: I am very glad I can address you as a fellow member, for my membership has been a source of both pleasure and profit. The reports of the Society are filled with matter of great interest and practical value and I am always glad to read them. Incidentally I may also remark that I esteem the "Florida Grower," as one of the best and most instructive publications of its kind which reaches my desk, and I receive them from all parts of the country.

I did not come here to speak on citrus canker, but I should like to add one word to the discussion. I hope that you will not make the mistake in Florida that we made in Massachusetts when we were fighting the gypsy moth. We had this pest almost exterminated when suddenly the Legislature, with the idea of economizing, stopped the appropriation for the work for two or three years. The work that had been done previously was more than lost, and the gypsy moth spread with terrible rapidity all over the eastern part of Massachusetts, and even into Connecticut. This mistake cost the

State many millions of dollars. It seems to me that if anything is needed in Florida today, it is a "stick-to-it" policy until the citrus canker is wiped out. I don't care whether I am reported in Tallahassee as having said this or not, because I know I am right, and any way I can flee to Boston and escape any condemnation that may come to me from that source.

I do not intend today to discuss the fertilization of particular crops, but I am going to speak more generally of the effect of the individual fertilizer ingredients upon the soil, and in regard to the proper relationship of one ingredient to another in fertilizers.

THE INORGANIC AMMONIATES

Nitrate of soda, nitrate of potash, and nitrate of lime, as we all know, are the three nitrates available for feeding plants. These are readily soluble in water and their nitrogen is in such a chemical combination that the plants can take it up at once; therefore, as far as immediate efficiency is concerned, there is nothing equal to these nitrates. Nevertheless, all of these nitrates are open to the objection, particularly when used on the light sandy soils of Florida, that they are subject to loss by leaching in case heavy rainfalls occur. This is for the reason that they move freely up and down in the soil with the movement of the soil solution, since they do not enter into fixed chemical combination with the soil constituents. Nitrate of soda is just as readily carried away into the drainage waters as any of the other nitrates.

If nitrate of soda or other nitrates are used on soil which is excessively wet, there is danger that the nitrates may be changed to nitrites and these are distinctly injurious to plants if present in considerable quantity. In fact this change which chemists call reduction may even go so far that a part of the nitrogen will pass off into the air as gas and be wholly lost. If heavy soils receive repeated applications of nitrate of soda the soil particles become deflocculated and the soils bake and become so hard that they can hardly be worked.

There is another characteristic of nitrate of soda that should be mentioned. If you apply it year after year, in large quantities on a soil which is naturally acid, it tends to make the soil somewhat less acid. Nevertheless, nitrate of soda cannot be depended upon for this purpose, for it does its work too slowly. If you are dealing with a soil that is very acid, the acidity should be corrected adequately at the outset by the use of lime. In most cases ground limestone is the most satisfactory form to use, for it is efficient and safe. If slaked lime is applied in considerable quantities to rather dry sandy soils, injury occasionally results the first season, or no benefit is observed, although by the second season it will have reacted with the soil to such an extent that no further injury will occur and the wished for benefit may then be expected.

Sulphate of ammonia is another source of nitrogen in fertilizers. The ammonia may be taken up unchanged to a certain extent, at least by certain kinds of plants at certain stages of their growth. This is

a relatively new idea, for we supposed a few years ago that no nitrogen could be taken up in the form of ammonia. It was believed that all the ammonia must first be transformed into nitrate by the soil bacteria.

When sulphate of ammonia is applied to the soil, you must remember that you are adding a combination of sulphuric acid and ammonia, and after it gets into the soil the ammonia is changed gradually into nitric acid. Plants then take up and utilize the nitric acid, leaving most of the sulphuric acid behind in the soil. Therefore, the natural tendency of the use of sulphate of ammonia is to make an acid soil still more acid. At the Rhode Island Agricultural Experiment Station we had soils which were naturally so acid that an application of 350 and even of 150 pounds of sulphate of ammonia caused positive injury to Indian corn the first season. In other localities of the State, after applying it two or three seasons, similar results were observed. It is obvious, therefore, that if your soil is already too acid you may not get good results from the use of sulphate of ammonia.

Fortunately, sulphate of ammonia is not subject to the same degree of loss by leaching as nitrate of soda, even though the ammonia is finally very largely changed to nitrates, for while this change is gradually going on a part of the ammonia is fixed in chemical combination with certain soil silicates and is held so firmly in the soil that the rain water cannot readily wash it out.

Ammonium chloride has been used as a fertilizer in England, but whether it will ever be used in this country in more than an experimental way, I do not know. It is, of course, possible that it may some day be produced so cheaply that it will be used for agricultural purposes. A mixture of sulphate of ammonia and ammonium chloride has been used on barley at Woburn, England, for many years. For the first few years no ill effect from its use was noted, but finally it began to affect the soil so seriously that barley could no longer be grown successfully. It was found, however, just as we had found much earlier at the Rhode Island Agricultural Experiment Station, that this condition could be completely overcome by adding lime.

You will find even today in some of the text books on agriculture, the statement that you should never apply sulphate of ammonia and muriate of potash in the same mixture, for if you do, it will result in the formation of ammonium chloride, which is poisonous to plants. I don't care where you read it or who tells you so, it is not necessarily true, provided only reasonable quantities are applied. It can only be true in the case of very acid soils which have not been properly limed. I have applied ammonium chloride to exceedingly acid soils and have had poisonous effects, but as soon as the land was properly limed injury ceased and it became a highly effective fertilizer. Remember, therefore, that you should watch the chemical reaction of your soil and be sure that it does not become too acid or you will not get the best results with either manure or fertilizer.

NITROGEN IN ORGANIC AMMONIATES

We have learned in recent years that certain forms of organic nitrogen can be dissolved, and like ammonia, be taken up by the plants directly, without the nitrogen being changed even into ammonia. This seems to be true of certain compounds known as acid amines and amido acids which are formed by the breaking down of the proteins.

If you apply organic ammoniates to the soil they are not washed out, as such, by leaching. When they are worked into the soil the first change which takes place is the breaking up of the complex nitrogenous compounds which they contain and the eventual formation of ammonia. When ammonia is formed from them it can enter into chemical combination with certain silicates of the soil just as ammonia does when it is added to the soil in sulphate of ammonia. I have already mentioned that some organic nitrogen can be taken up by certain plants before it is transformed into ammonia or nitric acid. I am not at all sure but that there may be certain advantages in having some of the simple, soluble nitrogenous substances present in the soil or fertilizer, especially when the plants are not getting a normal amount of sunlight.

The great advantage of organic ammonia in Florida is that you can apply it to your light sandy lands without fear of material loss by leaching.

Blood, dried fish, tankage, cottonseed meal.—In regard to the value of organic ammoniates I am safe in saying that blood is generally considered as the quickest, most efficient, and best of all the organic ammoniates, but I presume the total quantity produced in this country would hardly be enough to put a shovelful into each ton of fertilizer manufactured. Therefore, it is not an important factor when one considers the needs of the entire country. Dried fish may perhaps be mentioned as second in order of availability, but unfortunately the supply of this is relatively small. This is followed closely in availability by meat tankage. We depend for organic ammoniates, to a large extent in this country, upon meat tankage because of the large quantities produced in our slaughter houses.

Another important source of organic nitrogen is cottonseed meal. The time seems to be approaching, however, when we shall no longer have cottonseed meal available for fertilizer purposes, for it will all be required in the near future as feed for stock. I am sorry we cannot continue to have it as a fertilizer, but when one considers the general welfare of the country, we cannot do otherwise than consider it a great economic loss if we should continue to use as a fertilizer that which ought to be used as cattle food. From a national standpoint we should have every pound of cottonseed meal produced in the United States fed here at home, so that we can ship to Europe our own cheese and other dairy products, instead of shipping them our cottonseed meal and buying their ham, sausages, and cheese, as we have been doing in the past.

There are still other refuse materials

from various oil mills that can be used as fertilizers, but the quantities are limited.

Processed Fertilizers.—There is another class of materials of which I should speak. I refer to hair, waste wool, and t. felt, such as that in the hat beside you. There is a prevailing opinion that these materials are poor fertilizers, and they would be if they were to be used in their raw, untreated form, but I can take the hair and felt hats off of your individual heads—if you will let me—(laughter) and the wool off of the backs of your sheep, or the waste wool from the industries of the country, and, by treating them properly in a suitably equipped fertilizer factory, render all of the nitrogen highly available or even soluble in water. The Rhode Island Experiment Station and other Experiment Stations in New England and the United States Department of Agriculture have been testing materials prepared by these processes, and you will find it stated in a Government bulletin entitled, "The Nitrogen of Processed Fertilizers," that:

"* * * the water soluble nitrogen of this fertilizer should have an availability equal to or greater than the nitrogen of dried blood, or other high-grade fertilizers. These results are in accord with the results obtained by the plant method of determining availability.

"The general chemical principle which underlies the method for rendering available the nitrogen contained in most trade wastes, which are to be used as fertilizing materials, is shown to be either partial or complete hydrolysis of the protein of the wastes by any suitable means.

"The more complete the hydrolysis the more available the nitrogen in the fertilizer becomes, since the products of *complete hydrolysis of proteins are not only utilized by the plants themselves as nutrients, but they are more easily ammonified when placed in the soil than are the more complex compounds, such as peptones, proteoses, and the proteins themselves.*"

What does this all mean? It means that when we take waste hair, waste wool, and other similar waste materials containing nitrogen, and by proper treatment, make them as valuable or more valuable than dried blood, that we are supplying you nitrogen in most efficient form and at the same time are holding down the price of dried blood, the price of fish, and the price of tankage by lessening the demand for them. The more waste materials of this kind that are used, the better it is for every purchaser of fertilizer. Furthermore, the making of such material into the most valuable sort of fertilizers is a distinct form of public service. I am sorry to say that in some parts of the country laws have been passed requiring the manufacturer to state on the package if he has used any hair, wool, or any of these waste materials in the preparation of this fertilizer. Such a requirement is manifestly unwise, for, after treatment, these materials are no longer hair, wool, or felt, but they have been made as good as the best and what do you or I care what they came from originally. We want high availabil-

ity, or in other words, efficiency. Such requirements in State laws merely create unwise, unjust, and unnecessary predjudice against materials which can be and are made into the very best of fertilizers. It is not desirable that prejudice, or ignorance of the facts, should prevent the proper utilization of these and similar materials. We certainly don't want to fail to use these waste materials for this will lessen the supply of plant food and raise the price of all other ammoniates.

I shall be glad later to answer, if possible, any questions about fertilizers which you may care to ask, but first I will speak about lime.

LIME

I regret that the lime requirement of many of the plants grown in Florida has not yet been definitely determined, notwithstanding that I have personally experimented with several hundred varieties of miscellaneous plants. It has been found that spinach, lettuce, upland cress, cantaloupes, onions, peppers, martynia, asparagus and beets of all kinds are among the plants that are most injured on exceedingly acid soils. Practically all of the plants of the turnip and cabbage family, such as the cabbage, cauliflower, kohl rabi, kale, Brussels sprouts, and even carrots, cannot be grown with the greatest success on soils which are exceedingly acid.

Unfortunately, you have in this State vast areas where the soils are naturally too acid, and furthermore, there is no place in the country where greater care should be exercised in the use of lime, than right here in Florida. Some people get the idea, as soon as lime is found to be beneficial, that the benefit from its use will increase as the quantity used or as the frequency of application increases, but they generally make the same mistake that a friend of mine did, who was taking strychnine. He had been taking it under the doctor's direction as a stimulant, and just as he was starting on a long trip he took one or two extra doses to brace him up, with the result that it nearly killed him. It is very easy to over-lime land, particularly for some crops. For example, chicory does not respond to liming where beets will die for need of it.

Even cereals vary widely in regard to the necessity for lime, for on land that is so acid that you cannot grow barley to save your life, you can get a fair crop of oats and moderate to good crops of rye and Indian corn. The grasses also show marked differences in lime requirements, for if you want to grow Kentucky blue grass on a very acid soil you must lime it. In fact most of the ordinary grasses grown in the North are benefited by liming on very acid soils. I do not know what the effect of lime is on Johnson grass and Bermuda grass, or on Natal grass, and on the many other new grasses introduced into Florida recently. In fact I never desired to become intimately acquainted with Johnson grass in any way, for I know how difficult it is to "shake" it if you wish to, because of its extensive underground root stalks. We have in the North a second cousin to it—witch grass—but Johnson grass is witch grass multiplied by ten.

Both sugar cane and sorghum are often helped by liming. The carrot, though considerably benefited by liming on very acid soils, does not require it in the same degree as the beet. Turnips are usually benefited more by liming than carrots are, and as a rule the Swedish turnip responds more to liming than the flat turnip does. If you were to grow raspberries, currants, and gooseberries, you would find that they are all helped by lime, excepting possibly the black-cap raspberry. The blackberry is a plant which does not respond to lime on soils where beets die for need of it.

Peach trees, if limed at all, should be limed very little and with caution, for otherwise injury may result. It may often be a question whether it is advisable to lime at all for peach trees, unless for the purpose of increasing the growth of some catch or cover crop. The apple will thrive on very acid soils, yet liming may help if cover crops which need lime are to be grown in the orchard. Plums, the sweet black cherry, the Early Richmond cherry, and possibly all kinds of cherries will fail to thrive on very acid soils until they have been well limed.

The flowering plants differ as widely in their lime requirement as the vegetables, cereals, and small fruits. For example, the poppy cannot be made to grow on certain very acid soils, and I presume this explains why the poppy has never become a generally pernicious weed in the fields of this country. On the other hand, Silene orientalis, one of the flowering perennials, has been found to grow better on a very acid soil than it did after liming. Plants are, therefore, as different in their relation to liming as human beings are in their likes and dislikes.

You may perhaps ask whether I would use magnesian limestone or pure limestone, but I cannot answer that question off hand. Pure calcium limestone gives good results and magnesian limestone, under usual field conditions, has generally been reported as giving excellent results and sometimes it has proven superior to pure limestone. In fact, in Rhode Island I occasionally found this to be true.

I began some tests of the two kinds of lime on citrus fruits two or three years ago at Agricola, Florida, and to date the results seem to be better where the pure limestone was used, but more time will be required to show positively which will eventually prove to be the better. I only want to emphasize the importance of your finding out which is the better for the particular crop which you grow, and the only way this can be learned is to make a test on your own soil, with the crops which you customarily grow.

I have perhaps transgressed beyond the period allotted to me and I wish in closing to express the pleasure it has given me to attend this meeting of the Society. If you have any fertilizer "nuts" which I can crack I will be glad to do so. If they are too hard, or if no one has been able to crack them, I will frankly tell you so.

Chairman: I think frequently the questions that are asked bring out as much as the speaker gives in his talk. Dr. Wheeler knows a whole lot that he

has not told you, and he has told us some things that are a revelation to me. I get somewhat settled in my fertilizer ideas and think that I know just how to go ahead, and these fellows come along and make some new discovery, and I have to get settled again. I think it would be fine if some of you would ask Dr. Wheeler some questions and get a discussion started.

Mr. Miller: Dr. Wheeler used the expression nitrate of lime. I wish to know just what he has reference to.

Dr. Wheeler: I have reference to the nitrate of lime which is prepared in Norway, as a result of the oxidation of nitrogen by the electric arc process. In using it unmixed with other materials you should be careful not to get it into your own or your horses' eyes.

Another new nitrogenous fertilizer, calcium cyanamid, if used, ought to be applied two or three weeks, if possible, before the time the seeds are planted, because if applied at the time of planting it has an injurious effect upon the young germinating seedlings.

Following up what I said about the different fertilizers, I should add that in the preparation of commercial mixed fertilizers it is possible to bring together such quantities of these various materials in such a way that one will counteract and correct any possible unfavorable effect of the other. For example, nitrate of soda, which tends to puddle clayey soils and to make soils alkaline, can be mixed with proper amounts of sulphate of ammonia, which by itself makes soils acid, and the mixture will have neither of the undesirable effects.

I wish to emphasize the importance of getting the right combination of the various fertilizer ingredients for certain soils and crops. For example, I carried on experiments with potatoes in Maine a few years ago and found that differently compounded fertilizers, which were all of high availability and which had the same chemical analysis, produced differences in yields of thirty to forty bushels to the acre.

I have also found, for example, that 300 pounds to the acre of a fertilizer that was properly compounded gave an increased yield of cranberries worth forty to forty-five dollars more to the acre than the same amount of another fertilizer which had the same chemical analysis, and an even higher availability. The second fertilizer was compounded from materials not suited to the cranberry plants and to the character of the soil upon which they were grown.

I mention these results in order to show that we have to consider, not merely the question of the chemical analysis and the needs of certain types of soil, but also the problem of the selection of the proper kinds and proportions of the various fertilizer ingredients; since these factors often determine, to a considerable extent, the size and quality of the crop produced.

If you use nitrate of soda as an exclusive source of nitrogen on a soil that is very moist and rich in organic matter, you may expect that some of the nitrate

will be changed into nitrite, which is considered injurious to plants. In fact, under such conditions, this change, known as reduction, may go so far that much of the nitrogen may pass off into the air as gas and be lost.

On a cranberry bog in the Cape Cod district of Massachusetts, I have found it possible by the use of 300 to 400 pounds of fertilizer to the acre to secure a net gain of $150.00 an acre in a single year. This was an unusual and unexpected net gain, but the following year the net gain, after paying for the fertilizer, amounted to $100.00 an acre.

I am now endeavoring to supplement the excellent work of the local Agricultural Experiment Stations by carrying on somewhat similar experiments with potatoes, corn, oats, rye, and other crops in the States of Wisconsin and Minnesota. We have found, for example, that one must compound the fertilizer with special reference to the soil, climate, and temperature conditions, in order to get the best results in Maine, Wisconsin, and Minnesota, and the same principle holds true in compounding fertilizers to suit the peculiar soil and climatic conditions of Florida.

Mr. Bartlett: I would like to know the effect of an acid soil upon orange trees. I have a young grove and I find the soil has considerable acidity.

Dr. Wheeler: On a soil which is considerably acid a small or very moderate application of lime may improve the conditions, but just how great that application should be will depend upon the degree of acidity, upon how well the soil is supplied with organic matter, and upon the amount of moisture likely to be held in the soil. If the soil is very well supplied with organic matter and is reasonably moist you can safely use more lime than where the opposite conditions exist. A soil that is very dry and sandy should be limed with great caution. My advice would be to use on most of the area about half as much lime to the acre as would be indicated as necessary by certain of the so-called quantitative tests, or I might say, half as much as most people would recommend. I should then use double that amount on a few trees, and three times the amount on a few more, and should watch the results carefully and be guided by these tests in the future liming of the chief area. Great injury has been done in Florida in many instances by overliming citrus trees, and yet on very acid soils they need some lime.

Question: What do you think a reasonable amount to apply?

Dr. Wheeler: On many of the soils I should wish to limit the application to one ton of ground limestone to the acre for citrus trees, until it had been shown by test on a few trees that two or three tons would give better results. If I were starting with a previously unlimed soil, I should use much less lime than many chemists would report as the lime requirement, and then as I have said before, I should watch the smaller number of trees which received the larger applications and be guided by what they show.

Question: You mentioned potash. I

wish you would tell what percentage of potash a good fertilizer should contain.

Dr. Wheeler: No one can answer that question satisfactorily without a knowledge of the particular case, for everything depends upon the kind of crop and the character of the soil.

Question: Isn't it a fact that before this war broke out the fertilizer people were advising the use of from 10 per cent to 14 per cent of potash in their fertilizers?

Dr. Wheeler: I don't know as to that, but 10 per cent was the highest amount used in most parts of the country and I have seldom, if ever, known manufacturers to advocate the use of more; yet they may have furnished it at some time in response to a special demand from some grower who had an idea that more potash was needed.

Question: Isn't it a fact that today they are advising the use of 1½ to 2 per cent?

Dr. Wheeler: I am advising at least 4 per cent in Aroostook county, Maine, for potatoes, and we are even offering as much as 6 per cent. This larger amount is perhaps necessary along the Atlantic seaboard, where evidence of potash hunger has been afforded by the potato crops of the past two years.

Question: Isn't it a fact that the Government has made a survey of the potash lands of the United States and declared that there is enough potash to last a thousand years?

Dr. Wheeler: We have enough potash in the country to last many thousands of years, but it would cost so much to get it that it would not be economical. It is probable, however, that in the future considerable potash will be produced from a few sources at prices which can compete with European potash. I have in mind cement flue dust, the waters of Searles Lake, California, and two or three other sources.

Question: We have all over this country here in Florida what is called the scrub palmetto. I have seen the roots of that scrub palmetto burned and turn out over 20 per cent potash. Where do they get it? Does it come from the soil?

Dr. Wheeler: Certainly.

Question: Then you advise that we use potash in the fertilizer. Look at these oak trees down here on this street. Burn those oak trees and you get 8 per cent potash. Where do they get it? It has not been given to them. It is in the soil.

Dr. Wheeler: Along the Atlantic seaboard you can grow corn, and if you burn the cobs you will have 32 to 50 per cent of potash in the ash, and yet you have to use potash there, in order to get a full crop. Furthermore, the trees have collected their potash little by little through a long period of time, whereas your crop must secure its potash in a few months or weeks.

Question: Isn't it a fact, if you put humus or decayed vegetable matter into the soil, that it liberates potash that is in the soil?

Dr. Wheeler: To a slight extent, but not enough to meet the needs of the plants

on most of the soils in this State. This is especially true of many soils along the Atlantic seaboard and of light soils in many other parts of the country. I don't think there is any question, however, but what before the war, more potash was used in some sections than was necessary. This was partly on account of the German propaganda—another instance of German efficiency. We need a lot of it at Tallahassee now in dealing with the citrus canker situation.

Question: Do you advise the use of acid phosphate instead of the ground raw phosphate?

Dr. Wheeler: What for, and where?

Question: For anything.

Dr. Wheeler: Yes, usually. Acid phosphate has generally proved far superior to raw rock phosphate, particularly for truck crops.

Question: Isn't it a fact, as published by the Government of the United States, that nearly 50 per cent of the farming lands of Massachusetts had been abandoned in thirty years. Why? From the use of acid phosphate!

Dr. Wheeler: No, sir. Ladies and gentlemen, there never was a greater fallacy ever circulated in this country than that the soils of Massachusetts have been injured by acid phosphate, or by commercial fertilizers. Both improve the soil. If you were to ask me if I would use acid phosphate on citrus fruits, I should tell you that out of consideration for the prevailing notions regarding the superior merits of bone as a base, I might suggest the use of fertilizer having a bone base. I would do so until I knew, by actual experiment, that acid phosphate was as good or better than bone or a fertilizer having a bone base. We now have some careful experiments in progress right here in Florida which are designed to show the relative merits of acid phosphate and bone. These were begun one year after setting the trees, and in a few years the differences, if any result, should begin to be observable. It is certainly greatly to be desired that we should know more definitely than we do at present if one is decidedly better than the other for citrus fruits.

For most crops even bone is not quick enough, and ground rock phosphate is much slower in its action than bone. Careful tests have shown that only about 45 per cent of the phosphoric acid of bone is available the first year, and you have to wait ten or twelve years to get most of the remainder of it.

Question: Will you please tell us how acid phosphate is made?

Dr. Wheeler: Yes.

Question: I will tell you myself. It is made by taking one thousand pounds of phosphate and adding to it one thousand pounds of sulphuric acid, and calling it a ton of acid phosphate. I will prove it. Having ascertained how it is made, when you put it on the soil what does it do? Doesn't the sulphuric acid leave it, and the phosphate revert to its original insoluble condition? I have got the authority.

Dr. Wheeler: When you apply acid phosphate to the soil the phosphoric acid

goes back, to a certain extent and for a time, into less soluble forms, but even if this does happen, much of it enters into combination with lime in the soil, and these combinations with lime are still far more available than bone, and hence much more available than the phosphoric acid in raw rock phosphate. The soluble phosphoric acid reverts with lime to form dicalcium phosphate, which is readily dissolved by the carbonated soil water and by the carbonic acid thrown off by the plant roots. Even if some of the soluble phosphoric acid goes still further back and reverts to tricalcium phosphate, it is still much more available than the tricalcium phosphate of the native raw rock phosphate. It is usually desirable to have the soil properly limed if it is very acid, for if it contains little or no lime some of the phosphoric acid is more likely to pass into combination with alumina or perhaps with iron oxides, and when in combination with alumina and probably in some combination with iron the phosphoric acid is less available to the plant than when it reverts with lime.

Question: I would be pleased to know whether these combinations, if applied to soil that did not have any humus in it, would be of any benefit whatever. I find that most of our fertilizers are beneficial to the orange and other citrus fruits, provided we have sufficient humus in the soil. If there is no humus in the soil all of these applications would be a complete failure. I have not understood what class of soil is being talked about. What is in the soil? Is there any matter in this soil, so that it could work in conjunction with the application of these materials? If not, I think the whole thing would be a failure. I find that a great many of the citrus trees over on the East Coast, after they get to the age when they ought to be in perfect bearing condition, are dying. It must be through lack of humus. I think that a great many of these fertilizers are injurious. There were five or six men in California—I followed it out through the rural press for a number of years—testing out the point, and of the three things destroying the citrus trees, one was having a dry stratum, another was where the rootlets laid in the wet, and the third was where commercial fertilizer was used. It is a question to what class of soil are we applying these compounds.

Dr. Wheeler: As far as the gentleman's remarks are concerned, I will say that in some parts of California, for example, in parts of the San Joaquin Valley, if you take the soil and stir it up in water it will set as hard as a brick. The soils there are as different from those of Florida as black is from white. Those soils are most of them alkaline, although a few are acid. No fertilizer ever gives as good results on a purely mineral soil as it does on a soil that contains a good supply of organic matter. As to the effects of fertilizers on citrus fruits in this State every one knows that they are absolutely essential. I am finding in Wisconsin that where fertilizer is used with stable manure we get a greater return than when it is used on soils deficient in humus; so humus is a prime necessity in all soils.

Question: Last summer a year ago I made the only application of fertilizer that I ever made that contained no potash, but rich in nitrogen, and my grapes last year seemed to me the sweetest of any I ever had. I should like to know if it is known whether potash is a sweetener or if nitrogen is a sweetener.

Dr. Wheeler: Potash is necessary to the formation of sugar and the production of sweet fruit. If your grapes became sweet without it, it was due to the previous accumulation of sufficient available potash in the soil to produce at least that crop. You cannot get the greatest possible percentage of sugar in your fruit, or in sugar beets, if the soil is highly deficient in potash. I had sent to me from California two or three years ago fruit from two orange groves on acid soils separated only by a wire fence. Manure and coarse organic ammoniates had been used on one and lime and a complete fertilizer containing potash on the other. The first shipment consisted of naval oranges from both groves, and later Valencias from both. Upon peeling them I found that the peel was nearly twice as thick in the case of those grown where the manure and coarse ammoniates had been used, than it was on the oranges which were grown where lime and a complete fertilizer had been applied. The oranges grown with lime and fertilizer could be eaten without being conscious of the presence of "rag." The others had in every section of the orange so much "rag" that the average person would find it very objectionable. When it came to the degree of sweetness, there was a tremendous difference in favor of those grown with lime and fertilizer. Only two men out of twenty who tasted them liked those grown with the manure better, and when I asked why, they said they tasted more like lemons or grapefruit; and they were very fond of both.

Question: Before the war I used to apply 10 to 12 per cent of potash. During the war it was reduced to 3½ per cent, which we considered, before the war, a very small proportion, and as I said, a year ago last summer, I made two applications of fertilizer in the course of the year. This fertilizer contained no potash. With all that, my fruit seemed sweeter than ever.

Dr. Wheeler: You must have available potash present to get such results. If you already had enough available potash held within the soil to tide your trees over, I think that would be fully as good as potash applied the same season. If you want to get the highest percentage of sugar you must not use muriate of potash for the chlorine which it contains usually depresses considerably the percentage of starch and sugar during the season in which it is applied.

Question: Isn't it a fact that if citrus fruit is very sweet, it indicates that there was plenty of potash in the soil?

Dr. Wheeler: I should hesitate to say that it would indicate *necessarily* and in all cases that plenty of potash was present, but there is no question as to the effect of potash in connection with the building up of starch and sugar within the plant.

Question: It would seem that we have been applying too much potash.

Dr. Wheeler: I have no doubt that is true, in some cases.

Question: There was a period of two or three years when there were smaller applications of potash used, so that there could not have been last year anywhere near as much potash in the soil as usual, yet my fruit was so sweet that it was remarked on by everybody, and it was sweeter than that of most my neighbors.

Dr. Wheeler: I think that if you over fertilize with nitrogen you will find that your fruit will not be as sweet as it will if you use only a proper amount.

Question: I am at a loss to know whether we ought to lime or not. I would like to know when to apply the lime. In the case of almost all of our soils, if we put blue litmus paper into them they will turn it red. How can we determine when to lime or not to lime, by the use of this litmus paper?

Dr. Wheeler: The litmus paper test is not an absolutely infallible guide for all soils in all parts of the country, because there are soils in Minnesota and Missouri, and no doubt in other states of the Middle West, where the rainfall is light, that will redden blue litmus paper and yet they do not need liming. On this account I like to apply also the ammonia water test. In order to make this test, take some soil and put it in a glass or bottle, add considerable water, and then pour in some dilute ammonia water. Stir it up thoroughly and allow it to stand over night. If you find the next morning that the liquid above the soil has taken on a deep black, reddish-brown, or dark chocolate color, you have very good evidence, in addition to the reddening of the litmus paper, that lime, magnesia or both are lacking in the soil. In cases where there is an abundance of lime and magnesia in the soil at the outset, it will have combined with any acid organic matters formed, in such a way that the humus will not pass into solution in the ammonia water, for it is the uncombined acid or sour humus which gives the black, reddish-brown, or chocolate color. I always like to use the two tests, yet if you have a subsoil, or a surface soil that contains no humus, the ammonia water test has obviously no value.

A new and very simple test for soil acidity has been devised recently by Professor Truog of Wisconsin. It must be remembered, however, that even after a quantitative test is made, the farmer or grower must bear in mind the wide variations in the lime requirements of different kinds of plants, so that in the last analysis he will have to fall back on his sound common sense and past experience as an aid in deciding how much lime to apply to the soil.

Question: Would you advise having a complete soil analysis made of the land?

Dr. Wheeler: If you were to try it in Florida at the expense of the Agricultural Experiment Station you would bankrupt the whole State. It is true, however, that on certain types of soil certain simple in-

expensive tests may be helpful. In regard to the need of lime the tests are simple and inexpensive, but the chemical tests should in all cases be followed up by actual field trials. The kind of crop you are growing is often a more important factor than the character of your soil, by way of determining what fertilizer should be used. When all has been said and done, a reasonable amount of the same sound common sense to which I have previously referred must be used in the solution of these problems.

The Position of the American Potash Industry

A. W. Stockett, Bee Ridge.

During the greater part of the year 1918 the writer was attached to the Bureau of Mines in Washington, in charge of the potash section of the War Minerals Investigation, and the statements contained in this paper are based on information obtained in the course of that investigation, and represent the position of the potash industry at the end of the year.

Previous to the war, this country was dependent to a very great extent on foreign sources for the three principal ingredients of commercial fertilizers. Practically all of the nitrate of soda used is obtained from Chili, the sulphuric acid used in manufacturing acid phosphate was obtained largely from Spanish pyrites, and almost the entire supply of potash salts was imported from Germany.

The prospect of becoming independent of these foreign sources is promising. When the nitrogen fixation plants now being built by the Government are in full working order, there should be an ample supply of nitrogen. The development of our pyrites deposits during the war and the establishment of sulphuric acid plants should insure a sufficient supply at reasonable prices. The potash supply is the only weak link in the fertilizer chain, and the writer is of the opinion that it would be possible to develop a domestic potash industry, but it is doubtful if this now will be done.

The passing of the "Potash Law" by Germany in 1910, which at one time threatened to become a serious diplomatic question, first drew attention to our entire dependence on Germany for a very important element of plant food, and in 1911 Congress made an appropriation for investigating our own sources of supply. It was not, however, until Germany put an embargo on the exportation of potash salts in January, 1915, that the question became acute, and a serious attempt was made to develop our domestic sources.

The year 1915 may be said to have marked the beginning of the American potash industry, as in that year, according to the figures given by the United States Geological Survey, a little over 1,000 tons of K_2O were produced. This was increased to 9,720 tons in 1916, to over 32,500 tons in 1917, and to 52,125 tons in 1918.

About 75 per cent of the total output was obtained from natural brines, principally Searles Lake, California, and the lakes of Western Nebraska. The geographical location of both of these

sources is very unfortunate, as over 90 per cent of the pre-war supply of potash was used east of the Mississippi river, 50 per cent being used in the four cotton states of North and South Carolina, Georgia and Alabama.

The Desert Basin and Death Valley have long been names that appealed to the general public as probable locations of immense deposits of potash. These districts have been carefully examined by the United States Geological Survey, and as a result it may be stated that Searles Lake is the most promising individual source of potash at present known in this country. This is really not a lake, but the salt encrusted valley floor, the salt having an average thickness of about 75 feet and being permeated by a "mother liquor" brine. The extent of this has not been definitely determined, but it has been estimated to contain up to 20,000,000 tons of K_2O, which would be sufficient to meet the entire present requirements of this country for 80 years. Two companies are operating here, and one of them, the American Trona Corporation, is said to be the largest individual producer of potash in the country. The brine is of a somewhat complex character, and the successful treatment of it commercially was an interesting problem for the chemists. The potash salts produced at first contained a high percentage of borax, and were objected to on that account, but the company now claims to be turning out a product running from 75 to 80 per cent KCl, and containing less than 3.5 per cent of borax, and this should be suitable for use where a muriate is wanted. Soda and borax, and possibly salt as well, will be produced, and these by-products should assist in enabling potash to be produced from this source under normal prices. A low ocean freight via the Panama Canal would be an important factor in competing with foreign supplies.

The Nebraska lakes produced 55 per cent of the total output for last year. These comprise a number of lakes, usually of small extent, situated in the sand hill region near the western border of the state. They usually consist of a shallow lake of brine of varying strength, with a bottom of muck and hardpan, underlain by a sand impregnated with brine similar in composition to the lake waters. This is the principal source of the potash. Wells are put down in this sand, and the brine pumped to reduction plants, where the potash is obtained by evaporation. These brines are of very simple character, consisting principally of sulphate and carbonate of potash, with only a small amount of chlorine. The salts as marketed contain an average of 25 per cent of K_2O. It has not been found possible to make any definite estimate of the total potash contents of these lakes, but it is probable that the stores of high-testing brines is limited, and under normal prices it is very doubtful if the lower grades can be worked profitably, especially as this district is handicapped by a high freight rate, which at present amounts to over 50 cents per unit of K_2O to eastern points.

About 2,500 tons of potash were produced in each of the last two years from the alunite deposits near Marysvale, Utah. This was mostly in the form of a

high-grade sulphate, 97 per cent pure, which would be especially desirable for citrus growers. The purest alunite runs about 10 per cent of K_2O. It is crushed, and roasted in a rotary kiln, and the calcined material leached with hot water. The solution is filtered and the filtrate is then evaporated and the resulting crystals dried and sacked for shipment. No estimate of the cost of production is available, but unless it is possible to utilize the alumina in the residue, which is not being done at present, it does not seem probable that potash can be produced from this source at a profit at normal prices. Calcined alunite, containing 15 per cent of potash, has been marketed in small quantities for use in fertilizers, as it has been found by experiment that this is as effective per unit of K_2O as the soluble sulphate and chloride salts. If a deposit of alunite could be discovered in the East near the centers of demand for fertilizers, it is probable that the calcined material could be produced at a profit in competition with foreign potash, but with the geographic location of the present known deposits, the high freight rate per unit of K_2O will be prohibitive.

In the opinion of the writer, the dust from cement kilns is probably the most promising source of a permanent domestic supply. As the result of an investigation by the Bureau of Soils of the Department of Agriculture, it has been estimated that the maximum of potash that might be recovered from all the cement works in the country would be 100,000 tons of K_2O per year. It is not probable that this figure will ever be reached, as some plants do not have sufficient potash in the raw mix to make its recovery profitable, and others for various reasons would not find it advisable to install plants. It does not, however, seem unreaonable to expect that the amount from this source should reach 50,000 tons of K_2O per year, which is 20 per cent of our normal requirements. The geographical position of the cement industry is exceptionally fortunate, as approximately 70 per cent of the total amount of cement manufactured is produced east of the Mississippi, and this region consumes approximately 90 per cent of the normal supply of potash. The first cement plant to recover potash from the kiln dust was the Riverside Portland Cement Company, of California. Owing to litigation with the citrus fruit growers in this vicinity, who claimed that the fine dust escaping from the kilns was causing damage to the fruit trees, the company was compelled to take steps to abate the dust nuisance. A Cottrell electrical precipitation plant was installed, and when the dust thus collected was analyzed, it was found to contain about 10 per cent of K_2O, so that at recent prices of potash this was probably the most profitable part of the plant. The installation was completed early in 1913, and has been in continuous and successful operation ever since, so that there is no longer any question about the practicability of this method. The recovery of the maximum amount of potash and its concentration from the flue dust involved some very interesting chemical problems, which appear to have been successfully solved. At

the end of 1918 nine plants were reported as collecting and treating this kiln dust.

Another source which appears to have as great possibilities as the cement plants, although up to the present but very little has been done, is the dust from the blast furnaces manufacturing pig iron. Mr. R. G. Wysor made some investigations and experiments at the plant of the Bethlehem Steel Company, and it was found that with the Cottrell electrical precipitation, practically all the dust and fume entering the treater could be precipitated successfully. In many cases the iron ore used in manufacturing pig iron contains sufficient potash to make its recovery profitable. This applies to some of the Alabama ores, and these are well situated with reference to the demand for fertilizers. The amount of potash available from this source has not been definitely determined, but an investigation has been begun by the Bureau of Soils, and the results of this should be known shortly. Two or three plants have recently been completed and the commercial possibilities of this source should soon be decided.

The giant kelps of the Pacific coast have ranked second as a source of the domestic supply for the last two years. An experimental plant was erected at Summerland, California, by the Department of Agriculture for demonstrating on a commercial scale the various processes of extracting potash and by-products from kelp. The kelp is harvested by machine cutters mounted on barges, and brought to shore, where it is either dried and ground, or reduced to a char, which may be used direct as a fertilizer material, or treated to produce a high-grade potassium chloride. Six companies were operating in 1918, but this source can hardly be regarded as permanent under normal conditions, as far as the fertilizer trade is concerned, as the cost of production will be high, and it would be almost impossible to locate a source that is further from the principal centers of demand, as the Pacific coastal states, together with Hawaii, use less than 2 per cent of the normal potash consumption of this country. Attempts to transplant kelp from the Pacific to the Atlantic coast have so far been unsuccessful, as no suitable localities have been found, and the prospect of success of such a project is not considered promising.

The greatest potential sources of potash are the potash-rich silicate rocks, and of these the most promising are the greensands or glauconite of New Jersey, the Cartersville slates of Georgia, and the leucite rocks of Wyoming. Any one of these sources would be capable of supplying our entire requirements for many centuries. Many patents have been issued in the last fifty years for methods of extracting potash from these silicates, but no general commercial process has yet been developed. Several companies have been experimenting on the greensands on what may be called a commercial demonstration scale, and claim that under normal conditions they will be able to produce potash at less than $1 per unit of K_2O, and one of these companies is now erecting a large plant. Another company is operating on a small scale on the Cartersville slates, and producing a

material containing 4 per cent of water-soluble potash, which is being used locally as a fertilizer. Experiments have also been carried out on the leucite rocks, which give promise of being successful.

The development of a commercially successful process of treating the silicate rocks would solve the potash question permanently, and this problem should not be beyond the skill of American chemists and metallurgists.

Another source which promises a small but permanent supply is the waste from distilleries where molasses is used to produce alcohol. Small amounts are also being obtained from wood ashes, wool washings and other industrial wastes.

In conclusion, the writer is of the opinion that the sources of potash already discovered are sufficient to supply the requirements of this country, if sufficiently developed. The United States Geological Survey estimates the capacity of the existing plants at 100,000 tons of K_2O per year. The prospect of developing these sources was promising up to the time of signing the armistice, but it would require some form of assistance by the Government for a few years. This assistance might be given either by a moderate tariff or by subsidizing the domestic industry to a suitable degree. A proposal was also made that no potash could be imported from any foreign source without a license, and a license would be granted only to those persons who had purchased a proportionate amount of domestic potash, this proportion to be fixed by the licensing board, which would also have the power to vary the proportion if there appeared to be any attempt to form a combination to keep the price of domestic potash above a reasonable figure. In the opinion of the writer any one of these methods would have helped the development of an American Potash Industry without entailing an unreasonable price to the farmer, and our experience during the last four years would appear to be sufficient to justify the experiment.

Fertilizer for Citrus Trees

F. S. Ballentine, Ft. Myers.

The value of commercial fertilizers in relation to the citrus industry has passed the experimental stage. The question is no longer—"Are commercial fertilizers good and useful?"—but—"In what form or combination of materials will they produce maximum profitable results?" Agricultural chemicals, therefore, now occupy a position of prime importance, not only as to actual effect upon farm prosperity, but also as to the actual amount of cash which the grower has to spend; for his produce comes out of the soil and its amount and quality are most often largely dependent upon and determined by, the character of the plant food he puts into it. This offers a most complex problem, associated as it is with many essential and fundamental conditions of soil, climate, rainfall and method of cultivation; for, unless these conditions are satisfactorily met in every respect, crops are unable to make efficient use of the plant food within their reach.

During the war it was imperative that the crop yield of the country be vastly increased. And in view of the high cost of materials and labor, it is yet an imperative problem, the answer to which can only be found in improvements in all farm operations and in a vastly greater use of fertilizers, this being of the highest economic importance.

The three main elements of plant food, nitrogen, phosphorus and potassium, carry their own problems. The results already secured by the chemists have rendered the exhaustion of natural nitrate deposits no longer a cause of anxiety, although even today the process of obtaining nitrogen from the air is stated to be less than 5% efficient. The extension of this process has been one of the remarkable events of the war, but it will probably be a long time before nitrogen from this source can be given to the farmer in such quantities, and at such a price, as to make possible its extensive use. What can be done through the means of the electric furnace in the recovery of phosphoric acid is not so well proven, but there have been achievements in this field which point to large possibilities. The potash problem has occupied a major position in the agricultural field, but it has been solved to such an extent that, except for the first few months of the war, potash has been available in both quantity and quality. In addition to the many natural sources of potash that have been developed through the necessity of the past four years, there are great possibil-

ities of the recovery of potash from waste gases of cement plants and gas furnaces; it being stated by some authorities that by the development of this source the possible recovery of potash could be made to equal the pre-war consumption of the United States.

Unfortunately there still persists an impression that the fertilizer manufacturers have but a small supply of potash, and in some quarters it apparently is believed that the manufacturers themselves are fostering this impression. This is certainly not the case, for it was only during the first few months of the war that there was any restriction at all on potash. For a very brief period most manufacturers limited the amount of potash to from 3 to 5%. That, however, was only a temporary restriction very quickly abandoned and for the past three years any grower in Florida could at any time purchase as much potash as he wanted. The demand fell off naturally on account of the rise in price, coupled as it was with the increased cost of the other plant food elements and not because there was any lack of potash. And this American product has proved just as good as any that ever came out of foreign deposits.

During the first year of the war, recommendations were made to the growers to greatly lower the potash content, and in many instances eliminate it entirely because of the cost and the fact that a plentiful soil reserve was undoubtedly on hand. The basis for this, particularly with reference to citrus trees, was tank experiments made at Gainesville, in which it was demonstrated that practically no potash leached from the soil for the first three years, although a great deal more was applied than the trees could possibly use; but that after the third year the potash began to leach away quite readily. This shows without a doubt that the soil can contain a considerable quantity of potash, but that it eventually becomes saturated. For the past year, therefore, the growers have been cautioned that they have drained heavily on these reserves and must supply potash to their trees if they expect maximum results. If they are going to economize on their fertilizer at any time of the year, the best authorities have recommended that it is preferable to omit the potash in the spring application, bearing in mind that it is especially necessary to use complete fertilizers in the summer and fall. These recommendations are particularly for bearing trees, the use of potash in the spring not being generally advised on young trees except in those instances where they had had no potash during the preceding year. It is generally admitted that young trees can do well with very little potash.

No one knows how little potash is necessary for good results, for until the war potash was always easy to get, and cheap. Due to German propaganda the farmer had insisted upon more potash than even government scientists or fertilizer manufacturers advised, and there is no question but that more was advised than was actually necessary. As a result of the enforced necessity of using small applications of potash, the fallacy of using standard pre-war applications became in-

creasingly apparent to the majority of growers and it is believed by many that we will never get back to complete fertilizers carrying from 10 to 15% potash; and that from 5 to 8% will probably be as much as any grower will require. Some authorities state that were potash cheap again they would advise 2 or 3% in the spring, 4 to 6% in the summer, and 4% in the fall. This, however, is something that must be determined by some years of actual experience. Potash is absolutely essential, and there is no question but that a lack of it shows in angular, undeveloped twigs, thinner, less crisp leaves and a decided flatness in the flavor of the fruit. Potash particularly gives firmness of tissue, and therefore has great influence on the shipping qualities of fruit. At the same time it is not a "cure-all" in this particular, for with the heaviest applications of potash, climatic conditions and the general handling of fruit can cause enormous loss. As indications are at present, the fertilizer used by citrus growers this summer is going to average about 3½% potash. A great many of them are taking 5%, some of them as low as 2%.

Without doubt, 6 to 8% phosphoric acid is all that vegetable growth needs as a plant food, but phosphoric acid encourages all plant activities. An excess of it will help to relieve a lack of some of the other essentials, not in any sense of the word taking the place of these essentials, but by its presence making the supply more largely available.

It is regretted that the general tendency was to use only 4% ammonia this spring because of the high cost of fertilizer. It is generally conceded that under ordinary conditions the tree needs 5% ammonia in the spring, 4% in the summer and 3% in the fall. The minimum amount of ammonia required has been pretty definitely determined, for ammonia has always been the most expensive part of fertilizer except for a short period about four years ago. For instance, by state valuation ammonia used to be put at $3.65 per unit, and generally cost more than that, while potash and phosphoric acid were put at $1.00 and could be bought for less. Growers have always tried to get along with the least ammonia possible, and therefore the minimum has been very definitely established.

The proper proportioning of ammoniates is essentially important, there being a very great exactness possible in so planning and combining the ammoniates as to give a steady supply of available ammonia with the least possible waste. The time of availability is largely dependent upon temperature and moisture, points which can not be readily foreseen. But these also have effect upon the plant, so that the two generally keep in pretty good proportion. The plant grows faster and uses more plant food under such conditions as bring the plant food more quickly into availability. Therefore, fertilizer made on a general average, and used in an amount sufficient to supply the requirements of the tree, will give the best results. This amount is based on the size and condition of the tree and on both past and future crop. It has been accepted that a bearing tree requires fer-

tilizing three times a year, this being based on the growth in the spring, the growth in summer, and the root development in the fall. Naturally, there will always be present conditions requiring special treatment as to fertilization. But the best average results have heretofore been attained through the use of an average blend of the best grade of materials, the success being only in proportion to the skill with which the requirements of the tree were met.

Unfortunately the general tendency among the majority of citrus growers is to use fertilizers in too small amounts. It is not often that they make any kind of a test to learn what amounts of fertilizer they can use most profitably; nor do they take much advantage of the information compiled for their benefit through laborious study and effort on the part of the State and Federal Agricultural Departments, based upon years of scientific research and practical experience. This information, which applies not only to fertilization, but to general grove culture, and the control of insects and diseases, if studied and followed intelligently by the large majority, who are still clinging to old ideas and methods, would revolutionize the citrus industry in this State on a scale that would add millions of dollars to the pockets of these growers.

In conclusion I would urge each and every grower to study the bulletins which are supplied free of charge by the Experiment Station at Gainesville, with the determination to fertilize for maximum results, supplementing this with the best methods of grove culture, for, only by so doing can the desired results be obtained.

The Making of Composts and Their Use as a Fertilizer for Citrus Trees

Joe Knight, Elfers, Florida.

It is time that we, who are engaged in the work of agriculture, and especially those of us in Florida who are producing groves, consider very carefully one of the things that worries us most at present, namely, fertilizer.

There are many different kinds of fertilizers that could be used with good results, but what we want and what we need is a fertilizer that will give equally good results at the least cost. It is what we save on the farm and not what we make that counts. I believe that the manure saved from the stock on the farm is the fertilizer that we need. Manure is as good fertilizer, if not better, than any and can be obtained at less cost than any other.

Many farmers haven't the stock from which can be saved sufficient fertilizer for their groves; but they can at least save some, thereby reducing the cost of much of the commercial fertilizer that they would otherwise have to buy. Other farmers and growers are in the stock business as well as the grove business and can save the necessary fertilizer, thereby showing a profit instead of an expense.

A great many growers are depending on tractors to do their work and are discarding their work stock, thinking that they can do the work cheaper than with mules or horses. In one sense of the word, this is true, but in another sense it is not. The work animals will not only do the same work that the tractor does in the grove, but they will produce more than enough manure to pay for the feed bought for them if the manure is properly cared for. This, when returned to the soil, builds up its humus content, making it valuable for years to come, and so overshadows the difference in maintenance cost between the mule and tractor that there is hardly any comparison. The tractor has to be "fed" the same as the mule or horse and gives only work in return.

I have brought out this point, or rather fact, to compare the mule and manure with the tractor and commercial fertilizer. I believe you will agree with me that the argument is in favor of the hay burner; especially considering the fact that the average Florida soil is badly deficient in fertility and can only be built up by the use of humus and manure. Our soils show how much they are in need of organic matter, only when compared with some Northern soils which

have been made with manure and composts and which are made good soils to farm on for years to come, even if no fertilizer is added to them for as long a time. In some sections of the country, if the farmers bought commercial fertilizer and wasted their manure they would not be able to farm long, as their expenses would be greater than their profits.

The growers of this State have lately been getting such good prices for their fruit that they can afford to buy their fertilizer in a convenient form, at, as some of us believe, unreasonable prices, and throw away their manure. On the other hand, if they would save more manure and buy less fertilizer, they would get more profit from their fruit. Our European farmer friends who have been farming somewhat longer than we, usually consider the worth of their farmer neighbor by the size of his manure or compost pile.

It is not possible to maintain the fertility of soils economically without the use of live stock. To farm without the use of manure results finally in the exhaustion of the soil. The neglect in preserving and increasing the quantity of farm manures has induced a great drain on the natural resources of the American farms and especially those of the southern portion of the United States. It is just as easy to save the manure on the farm as it is to haul it off or waste it, and our soils are badly in need of it.

The question is often asked: "Does manure hurt citrus trees?" Many of the growers believe that it does. Frankly, I don't. I have so much confidence in manure properly built up, cared for and composted that I am using it right along on my own groves. I don't believe that compost fertilizer will injure citrus trees any more than any other kind of fertilizer. Nearly any fertilizer will hurt trees if too much is given them, or if it is not properly applied. I have seen stunted trees brought out and made to grow right off with manure where commercial fertilizer absolutely failed. In fact, I have done the thing myself.

In my grove, around the house I live in and around the house of one of the families on the place are trees, some of which are five years old and others about nine or ten years. The chickens were allowed to roost in these and up to three years ago when I used commercial fertilizer only, I noticed that these trees were always larger, greener and healthier looking than any of the others. Today these same trees, as well as others of the same age which have been composted, considering the injury from two or three cold spells, look as well as one could wish. The fruit is as pretty and perfect as any market could desire.

I don't mean to say that manure alone makes pretty fruit. Fruit on pine land can be made pretty and of good quality only by spraying. I am only showing that manure does not hurt the fruit or the tree. It does not ammoniate the fruit and tree or give the tree foot rot any more than does any other kind of fertilizer. On the other hand, it is just as good a fertilizer as there is.

I have a five-acre grove of nine-year-old grapefruit trees from which six cars

of fruit were shipped last season, each of which contained 360 or more boxes. This grove has had a larger crop each year since it first started bearing five years ago, or when I came into possession of it, and the trees have maintained a steady and rapid growth. I have often wondered why a grove this young has produced such a big crop each year, maintained its healthy look and at the same time put on much growth when I have applied commercial fertilizer to it only in limited quantities. The truth of the matter is, that the former owner applied manure to the trees every year from the time of planting until we took charge of the grove. These trees are now getting the benefit of the manure.

Manure is not only a stimulant for the time being, but is a soil builder and a fertilizer, and its effects will last for an indefinite time. Manure composted and added to the soil not only serves as a fertilizer for the trees, but adds humus to the soil, which causes it to hold its moisture better. The sandy soils of Florida are subjected to much leaching and should be built up with humus and organic matter. Since the most of our groves are located on such soils, they need the compost fertilizer.

Compost as a fertilizer for citrus trees, in my opinion, can't be beat, and certainly is the cheapest fertilizer that we can get. There are many different ingredients that can be used to make compost and many ways to make it. I let my mules make my compost for me right in their stalls, thereby saving unnecessary handling of the manure. Every two or three weeks I put a layer of acid phosphate in the stall and on top of this a litter of old beggarweed hay. I usually save and use the hay injured by rain when gathering it. The hay being the top layer, the stall is kept pretty sanitary until it gets damp or soggy again, when it is then time to put in more phosphate and hay.

Composting in the stalls is the way to make the best and most valuable compost, for the reason that the rain can't get to the manure to leach it and the compost is constantly absorbing the liquid from the mule that stands in the stall keeping the compost packed down and excluding all the air. This manner of composting not only adds to the quantity of the compost, but also to the quality by absorbing the liquid, which is the most valuable part of the manure.

Manure without the liquid is not a balanced fertilizer. Without it I would consider the worth of the manure reduced to fifty per cent as a fertilizer, but for soil building the organisms are still there. I might state that I don't keep my mules shut up in their stalls when they are not working, but of their own accord they stand in them the most of their time, I think, to keep away from flies.

I might further state I have no trouble from disease on account of the animals standing in what some might term an unsanitary stall. The mules are in good condition and free from all disease. About every three weeks I use about fifty pounds of acid phosphate to a stall nine by twelve feet in size, covering the manure well. This amount of available

phosphoric acid gives the compost a high percentage of phosphoric acid.

Manure to be used in compost should never be left piled in the open barnyard as is often the case when manure is bought from different stables, but should be placed under a good shelter where the rain and sun cannot get to it. I wouldn't use manure for compost at all unless it was kept absolutely under shelter from the time of its first being produced until ready to be applied as fertilizer.

I have used several different kinds and brands of ground rock phosphate in making my composts, and have heard much said about the lime in the untreated rock freeing the ammonia if used in a compost with manure. I have obtained good results with all of them on my trees as far as I can observe. Although I wouldn't attempt to say whether or not it released the ammonia, I have avoided using it and am now using only acid phosphate. This having been treated with sulphuric acid, has the lime changed into a form that will not free the ammonia, and at the same time puts most of the phosphoric acid in an available form.

When the stall is full I clean it out, carry the compost away by means of a litter carrier suspended from an overhead track, which runs to each stall door, and then leads to a cement pit where the compost is dumped and left to rot. Urine from the cows is poured over it almost every day. This seeps through it and helps to maintain its ammonia contents.

The manure from the cows has, of course, to be composted differently, because the cow stalls as well as the barn has to be absolutely sanitary in order to get clean milk. Therefore, the manure should be cleaned out daily. For the purpose of cleanliness, I have the floor cemented and equipped with Louden cow stalls and stanchions, with a gutter drain just behind the cows. I put a good litter of straw on the stall floor every night and keep the cows in their stancions all night, thereby saving their manure. This is cleaned out of the gutter every morning and put into the litter carrier overhead and dumped into the cement pit. The liquid from the cows caught in the gutter drain drains out at the end into an underground pit, to which a pump is attached. The liquid is pumped into the carrier and dumped with the manure into the pit. By these means, you not only keep a clean and sanitary barn, but you save absolutely all the manure as well as the liquid, which is always the most valuable part and which has to go into the compost to make it a balanced or complete fertilizer.

Cows treated in this way and kept in clean stalls will always give more milk. They appreciate kind treatment as well as a human being. In composting the cow manure I build it up with acid phosphate, using about 200 pounds to the ton. I use straw right in the pit, just as I do in the mule compost in the stalls.

Where manure is properly saved you will be surprised how much can accumulate in a limited time and with a limited amount of stock. Compost fertilizer using manure as its chief component, is a most valuable asset to the Florida grower. And, after all, does it not seem foolish to waste our manure and buy fertilizer?

Citrus Fertilizer Experiment: A Resume of Ten Years' Work

S. E. Collison, Gainesville.

The title of my talk this morning is probably a little more ambitious that it should be, because I don't mean to attempt, in the short time at my disposal, to discuss every phase of the ten years' experimental work which the Experiment Station has been carrying on with regard to fertilizers for citrus trees. I only intend to touch on some phases of the work, which I hope will prove of some interest.

I have already had the pleasure of appearing before an Orlando audience during the "Better Fruit" campaign, and I discussed one side of this question, but this morning I trust that I will have a little material which is new to offer you, which has been worked up since that time, and I will not simply repeat myself, going over the same ground that I did two or three months ago here in this place.

Ten years ago the Experiment Station began some experimental work with various fertilizers on orange trees. They began with the young tree, the Station purchasing the trees and setting them out, choosing the land and outlining the experiment. Ten trees were used for each plot in the experiment, and these ten trees received the same kind of fertilizer treatment; some of the plots, in addition to the fertilizer treatment, were mulched with leaves and dry hay and material of that sort, and others were cultivated during the entire year, while most of the grove was cultivated up to the beginning of the rainy season; weeds were then allowed to grow up and occupy the land during the rainy season. There were forty-eight plots, of ten trees each, in the experiment. We adopted what we called the standard formula for the entire experiment, consisting of 5% ammonia, 6% phosphoric acid and 6% potash. In other words, practically all the plots received that formula, the fertilizers coming from various sources. Then, again, we adopted what we called the Standard Mixture, consisting of sulphate of ammonia, acid phosphate and high grade sulphate of potash. We had a number of plots through the grove which received that special mixture, consisting of those three materials. Then, in addition to the sulphate of ammonia, we used four other sources of ammonia—nitrate of soda, steamed bone, cotton seed meal and dried blood. In addition to the acid phosphate we used four other sources of phosphoric acid—steamed bone, dissolved bone black,

basic slag and floats. In addition to the high grade sulphate of potash we used also the low grade sulphate, muriate, kainit, hardwood ashes, and nitrate of potash, so that we had plots represented in the grove, plots of ten trees in each case, which were receiving one of those different materials or the other. We had all the materials represented in the various plots in the grove.

Now, at the beginning of the experiment we adopted two pounds per tree three times per year, as the amount of fertilizer which we would use. Then, again, we have had one plot which got just one-half that amount, or one pound per tree three times per year. Then we doubled our standard amount on another plot, giving the tree four pounds of 5-6-6 mixture three times per year. Then, again, we doubled that amount, and one plot of ten trees got eight pounds of this Standard Mixture of sulphate of ammonia, acid phosphate and high grade sulphate of potash three times per year, or twenty-four pounds per year.

Chart 1 shows the amount of growth made by some of those plots. I will have to explain this chart a little bit. The experiment ran for ten years, and I divided this off into ten sections, beginning 1909, 1910, so on to 1918. Every year we measured the trunks of the trees a definite distance above the bud, and took the diameter of them, and counted that as the amount of growth made by the tree, averaging the measurement for the ten trees of each plot, and considering that as the average amount of growth made by each tree in the particular plot. We

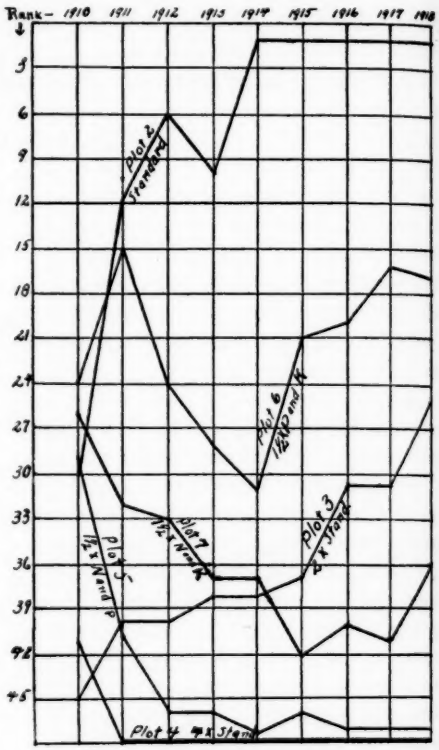

CHART 1.—Showing the Effects of Excessive Amounts of Fertilizer.

took various notes on the general appearance, size of the tree, etc. Those diameter measurements gave us definite figures as to the amount of growth made by the trees in the various plots for each year of the experiment. The plots that made the most progress are up here (indicating). In other words, the plots making the most growth would be represented by the straight line along here, provided it made the most growth every one of those ten years. Of course the

growth of those plots fluctuated from year to year.

First, taking the top curve representing plot No. 2, receiving the Standard Mixture of two pounds three times per year. That two pounds was increased from year to year, as the trees became larger. In 1910 the amount of growth that it made placed it as No. 30. Twenty-nine plots made more growth than this standard plot.

Then, going on to the next year, 1911, we found that that plot had made an amount of growth which placed it in No. 12 place. At the end of 1911 there were only eleven plots which had made more growth during that year than this standard plot. Then at the end of 1912 it rose up to No. 6. 1913 it dropped down to No. 10. In 1914 it advanced until it had made more growth than any of the plots in the grove. Then for the remaining five years it remained in that position. This curve shows the comparative amount of growth made.

Question: How much fertilizer did that get last year?

Prof. Collison: Last year it was fertilized at the rate of six pounds three times per year.

As stated a moment ago, another plot (plot 3) received just double the amount of our Standard Mixture, or beginning in 1909 it received four pounds of the same fertilizer three times per year. This plot is represented over here. (Indicating.) In 1910 it ranked No. 45. There are only three plots which made less growth. You see how it runs here. It keeps going up, until in 1918 it ranked about twenty-fifth, but you can readily see, by comparing this curve with this one over here (curve for No. 2), that that plot was receiving too much fertilizer. It was getting entirely too much, but as the trees became older it was able to survive the injury caused by the fertilizer, so that towards the last it was not getting much more than it could use. It was not getting enough to cause any great amount of injury, in other words.

Then, again, another plot (plot 4) got four times as much as our standard plot represented here, by plot 2, or eight pounds of fertilizer three times per year. This curve represents the comparative amount of growth of that plot. It starts here at No. 40 in 1910, and goes on down until the last seven or eight years it has been the plot making the least amount of growth of any in the grove. You see, by the way that curve runs there, that it was making very little growth. I might say that by the end of 1912 half of the trees in that plot had been killed entirely from the effects of the excessive amount of fertilizer. About the end of 1913 we discontinued using those large amounts.

Comparing the size of the trees in plot 4 with the size of the trees in plot 3, the former would not be over 25 per cent as large as the trees in the latter plot, showing that for young trees four pounds of fertilizer three times per year was too much, and caused an injury, and that eight pounds was beyond any limit that could possibly be used with benefit. It simply killed the trees. On those three plots which I have been discussing, we used the same amount of 5-6-6 mixture, sulphate of ammonia, high grade sulphate

of potash and acid phosphate. I have also three plots on which only two of those elements were increased, and the third remained the same as in our standard plot.

This plot here in this curve (plot 6) got one and one-half times the amount of phosphoric acid and potash that was used on plot 2, (indicating) and got the same amount of sulphate of ammonia as plot 2. You see how it runs. During the first two years it made a fair amount of growth, then the effects of the fertilizer, (that is, the effect of too much phosphoric acid and potash) began to show, when it dropped back, but when the trees became older they were able to stand the effects of the increase, and began making a better growth. As stated before this plot received one and a half times the amount of acid phosphate and sulphate of potash.

This plot here (plot 7) got one and a half times the amount of sulphate of ammonia and potash, but the same amount of phosphoric acid as the standard plots. You see that, comparing plot 7 with plot 6 they show at once that excessive amounts of sulphate of ammonia and potash are more injurious than excessive amounts of phosphoric acid and potash. You see plot 7 goes right down, and it ranks lower and lower, comparing the amount of growth made from year to year.

The third plot or plot 5, got one and a half times the standard amount of ammonia and phosphoric acid, and the standard amount of potash, and it made the least growth of any of the three. At the end of 1910, that is, at the end of the first year, it began going on down and kept falling back that way, until it ranked next to our lowest plot. Those three curves for plots 6, 7 and 5 bring out the fact that ammonia and phosphoric acid in excessive amounts are more injurious than any two of the other elements in combination. The amount of growth made there in plot 5 is considerably less than where the ammonia and potash were increased, as in plot 7, bringing out the fact that ammonia appears to cause more injury, when used in excessive amounts, than the other two elements.

I might say the formula used here on plot 5 would figure out 7½ per cent ammonia, 9 per cent phosphoric acid and 6 per cent potash.

We had one plot which received no fertilizer during the entire ten years. (See chart No. 2.) It was cultivated like the remainder of the grove, but received no fertilizer. This line represents the ranking of that plot. It ranked No. 9 at the end of 1910 and No. 9 at the end of 1911—stood up among the best plots for the first two years, then from 1911 on it began to drop, and the general tendency is to drop very rapidly.

Question: Was that on a pretty good grade of soil?

Prof. Collison: I should say that this soil was probably about the average citrus soil. It contained a very fair amount of phosphoric acid, averaged about one-tenth of 1 per cent, and was above the average in organic matter too.

There were three plots which were cultivated about every ten days during the entire year for the entire ten years. This curve here represents one of those plots, plot 46. During the first four years it

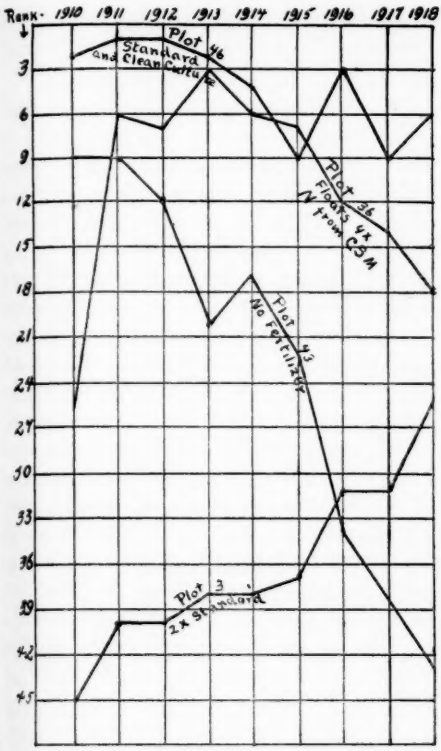

CHART 2.—Showing the Effects of Various Treatments.

ranked either No. 2 or No. 1, making practically the best growth of any plot in the grove. Then from 1912 on the the tendency is to go back, the trees not making as much growth as others of our plots. I might say that this plot, plot 2, (See chart No. 1.) received the same formula, the same materials and the same amounts. The only difference between the two is that plot 46 received cultivation during the entire year, and plot 2 only up to the rainy season. This brings out the point that cultivation may be overdone. I think that a good many, perhaps the majority of the growers, will agree that cultivation for young trees is usually the thing to follow. During the years when the trees were young it increased the growth. After the first two years the amount of growth is not as much as other plots which were not cultivated continuously. I will discuss one more curve on the chart. This curve represents plot 36 which received its phosphoric acid in the form of floats. It received cotton seed meal as a source of ammonia, and high grade sulphate of potash. This plot received four times as much total phosphoric acid as plot 2. The formula would run 5 per cent ammonia, 24 per cent phosphoric acid and 6 per cent potash. You see how it behaved. It ranked No. 26 among the 48 plots in 1910, and rapidly increased in growth. In 1913 it had a tendency to go back; from 1913 on to the end of the experiment it made less and less growth. The ammonia of the cotton seed meal and the phosporic acid already present in the soil were largely responsible for the growth made here, so that as the trees became older they had to depend on the phosphoric acid of the soil to supply growth. When they could not get enough of it they began dropping back.

Another plot which received the same amount of floats as this and sulphate of ammonia behaved very similarly to this one. At the end of the experiment it ranked No. 19, while this ranks No. 18, so that cotton seed meal apparently was very little better than sulphate of ammonia in connection with the floats.

Just a few words in regard to those fertilizers which, in our experience with this work, produced the most growth. In this experiment we found that the largest amount of growth was produced by sulphate of ammonia, acid phosphate and high grade sulphate of potash. The plots receiving those three materials made more growth, at the end of the ten years, than any other plots. However, the nitrate of soda plots, and plots receiving steamed bone have made almost as much growth as those receiving sulphate of ammonia. Perhaps if we had duplicated this experiment on the same land, we might find the second time that one of those other materials would give as good results as sulphate of ammonia, but on this particular piece of land, sulphate of ammonia proved to be the best source of ammonia, acid phosphate the best source of phosphoric acid, and high grade potash the best source of potash. However, I would not advise using simply those three materials, without any change at all, for any continued length of time. We all know that sulphate of ammonia, if used continuously, increases the acidity of the soil, and if used in large amounts, will finally bring about so much acidity as to be positively injurious, so that if we use sulphate of ammonia and nitrate of soda together—the nitrate of soda in the spring and sulphate of ammonia in the summer—we could keep our soil in better condition, and undoubtedly get better results. I might say that I had one plot in which the ammonia was supplied half from sulphate of ammonia and half from nitrate of soda. It didn't make quite as much growth as the best plot; it made almost as much, and the difference was so slight that in another experiment it might do as well, or perhaps even better.

We used ground lime stone and other alkaline materials. We used ground lime stone at the rate of ten pounds per tree. We used slaked lime at the rate of five pounds per tree, scattering about the tree the same as the fertilizers. Then one plot received potash in the form of hard wood ashes. Several other plots received an alkaline material in the form of slag, and nitrate of soda was used in connection with the slag. In every case where we used those materials we noted some injury to the trees. The injury was most severe where the ground lime stone and slag were used. I might say that ground lime stone was applied in the spring of 1909, '10, '11 and '12, and that after 1912 no ground lime stone or air slaked lime was applied. In 1912 we noted that those plots receiving these alkaline materials showed a large amount of frenching. While we had some frenching at times over almost the entire grove, even then it was much more severe on the part receiving alkaline materials. On the ground lime stone plots and on the slag plots the frenching was so severe that partial defoliation took place and the leaves turned yellow. One could stand on the side of the grove and pick those plots out by the yellow leaves. Where the ground lime stone and the air-slaked lime were used, the soil became alkaline, and remained so until 1916 or 1917, although no alkaline materials had been used after 1912. On the slag plots the soil never did become alkaline. The acidity decreased probably one-half. The

soil never was alkaline, yet we got that severe frenching on those slag plots just the same as we did on the ground lime stone plots. The attack of frenching on the air slaked lime plot was never severe, and as time went on the trees became as healthy, to all appearances, as any of the trees in the grove. In fact the plot receiving the air slaked lime, ranked No. 4 at the end of the experiment. There were only three plots making a better growth than that plot. We discontinued the use of the air slaked lime after 1912.

In this experiment at least we have gotten very disappointing results from the use of various alkaline materials, especially ground lime stone and slag. The soil in which the slag was used, as I said, never did become alkaline. We didn't use enough slag to change it to the alkaline condition, but they were some of the most severely affected plots in the grove.

Question: Mr. Chairman, may I ask Mr. Collison one question? In your standard plot there, will you state just how you increased the fertilizer? You started with trees the first year with two pounds per tree?

Prof. Collison: We started with two pounds per tree three times per year.

Question: Two pounds per tree, divided so as to make three applications?

Mr. Collison: Six pounds per tree per year.

Question: That is the first year they were set out?

Prof. Collison: Yes. They got that amount for the first three or four years—three years any way; and then we gradually increased it from time to time, until at the end of 1918 they got six pounds per application, equivalent to eighteen pounds per year per tree.

Question: Are the formulas changed at different times of the year?

Prof. Collison: We changed the amount of ammonia so that we got 2½ per cent ammonia in the Fall. The amount of ammonia was reduced in the Fall. That was in all the plots.

Question: Wasn't that a very dry piece of land?

Prof. Collison: My opinion is it was quite dry. We had two plots which we mulched during the entire year. Dry leaves and other material were placed around each tree, about four or five feet from the tree, and that mulch was kept there during the entire year, except when the fertilizer was applied. Those two plots made practically as good growth as any of the plots in the grove. Not quite as much growth as the best plot, but almost as much growth. We had one plot on which the amount of potash was changed. This plot received 7½ per cent of potash in the summer and fall, and 3 per cent in February. It got the same amount per year, but the amount at the different seasons changed. That had no beneficial effect apparently.

Question: Was this on Gainesville land?

Prof. Collison: No. In Lake County.

Question: How much fruit did they put on?

Prof. Collison: They never did bear a heavy crop of fruit. It was one of the disappointments of the experiment

that we never got them to bear a heavy crop of fruit. This was due largely to dieback in the trees and to cold injury.

Question: Tell us something about soils. Were those soils impregnated with clay, or light sandy soil?

Prof. Collison: No, no clay close to the surface at all. We went down five or six feet, and it was sand.

Question: Similar to the soil around the middle section?

Prof. Collison: Yes, similar to the high pine soil, with its sandy sub-soil in Lake County.

Question: Were those specially selected trees?

Prof. Collison: They were specially selected trees from the nursery, selected specially in regard to uniformity of size, age, etc., and the first year's measurement showed that, so far as the trunks were concerned, they were very uniform in size.

Question: What stock were they budded on?

Prof. Collison: The trees were Valencia budded on sour stock. All came from the same nursery.

Question: Were any experiments made with less than two pounds of fertilizer except the one with none? Were any made where you used one pound?

Prof. Collison: Yes. It made practically as good a growth as our best plot. Seeing the trees today, one could not note any difference in the size of them.

Question: When did you make your three applications?

Prof. Collison: We usually tried to get the first one on in February or early March, the next in June, and third in October, although this was not strictly adhered to.

Question: After the experiment has been made, what do you recommend as being the best thing for the starting of a young grove—a two pound formula?

Prof. Collison: That is a hard question to answer. On that type of soil I would say one pound per application to the tree the first year. This soil was somewhat above the average in fertility. On a poor type of high pine land two pounds per application per year would perhaps not be too much. We found one pound per tree on this particular soil as good as two pounds.

Question: Did you have any one plot which averaged better fruit than others?

Prof. Collison: We never got a heavy crop—I might say a full crop—during the experiment.

Question: Why?

Prof. Collison: I don't know. While dieback and cold were inportant factors perhaps the question of bud selection from bearing trees would apply here. I sometimes thought we got buds from trees that never had borne heavy crops.

Pruning in the Grove

S. C. Inman, Florence Villa, Fla

The privilege of addressing the annual assembly of The Florida State Horticultural Society is an honor which may well be appreciated by any man. I frankly assure you that I undertake the exercise of this privilege with misgivings as to whether I shall be able either to instruct or to amuse you.

The subject assigned to me for discussion by the Committee is "Pruning in the Citrus Grove." Whether you approve or condemn the practice of pruning your trees, you are compelled to admit that the custom is no "new-fangled idea" for it has been handed down to us from our forefathers in time immemorial. It would seem therefore that about "the last word" so to speak, might have been said a century ago; and I have no doubt but that the records of the meetings of this society would show that the topic has been handled, perhaps many times by those far more experienced and competent than I.

I wish it to be understood that I do not pose before you as an authority or a critic on the subject, but will give you such suggestions as it seems to me may be helpful to those who have had little or no experience. These suggestions are largely deductions from my own experience and from close observation of the work of others.

For the past fifteen years I have been engaged exclusively in the growing of Citrus Fruits. Every sort of work that ordinarily comes along in the operations of an orange grove I have performed and pruning has come in for its full share of my attention. I am aware that some of my notions in regard to pruning are not in strict conformity with the notions and practices of others, but I do not dogmatically insist that you adopt them in your pruning operations unless they appeal to you. There are but few "hard and fast" rules to be laid down in regard to pruning, though there are some general principles which should receive due attention from all growers and pruners.

First, we should do our heavy pruning, as far as possible when the tree is most dormant (winter), and probably January being the choice time. The time, however, admits of some flexibility. Do not prune heavily when the sap is active. When new growths are putting out, do not prune at all.

There is another opportune time for pruning, which we will consider second choice. This is after the Spring growths have fully developed and hardened, and

before the summer growths which follow the rainy season. At this time, usually about July, varying somewhat with the seasons, the tree is quite dormant. Very extensive pruning can hardly be recommended at this time, but light work may be done. Now these are the choice seasons, and when possible your pruning should be done at these times.

I insist that heavy work be accomplished during the winter, but as, in many cases, it is practically impossible to do all needed work in this line within these narrow limits of time it is sometimes necessary to overstep the limits. The citrus tree is an accommodating creature, and admits of considerable flexibility as to just when to do light pruning.

In performing the work, do it in a mechanical, workmanlike manner. Make all cuts close and smooth. Do not saw a limb off at right angles, but parallel with the member from which you are cutting. Do not leave protruding stubs. Cut close, even though it leaves a larger wound. The latter will heal rapidly, but the stub will not heal until it first decays away.

Paint all wounds that are as large as an inch in diameter, using heavy white lead-linseed oil paint. The addition of Raw Sienna with a dash of Chrome Green gives a color almost exactly like a healthy bark, thus camouflaging the wound.

To cut off a large limb, saw the lower side first until your saw binds, then saw the upper side two or three inches further out. The weight of the limb will cause it to snap off. Then continue sawing from the lower side until the stub is removed. This will obviate the splitting down of the limb, and making an ugly wound.

As to the extent to which we should prune our bearing trees, growers have different ideas, varying all the way from the ultra-conservative, who in fact does not prune at all, to the extreme radical, who insists on cutting off all the large lower limbs, though it may take half the entire top. He also prunes each of the remaining branches from the trunk out, leaving only a tip of foliage at the extremity of the branch, so that the foliage is a mere shell as it were, covering the frame-work of the tree.

The first named gentleman is content to have his trees a congested mass of small twigs, non-productive sprouts, vines, grey moss and dead wood. He certainly escapes the likelihood of overpruning, if such a danger exists; saves a lot of honest labor; and gets a little fruit now and then. He is almost sure to be as conservative in the amount of fertilizer and labor expended on his grove and of course he does no spraying. What fruit he happens to get he regards as pretty nearly "Clear Velvet." His bank account is usually small.

As to the other extremist's plan: Well, I haven't much to say. It is mighty nice getting through his grove, having no obstacles in the way of a free movement when plowing, harrowing, spraying, etc., and the contour of his rows of trees is very symmetrical and beautiful. But he derives little fruit from those large healthy branches which he so ruthlessly sacrificed, while I have had the satisfac-

tion of picking a great many oranges and grapefruit from low growing limbs.

I have observed that his severe pruning is usually followed by an immoderate tendency of the trees to put out a great many sprouts, which he proceeds to pull off. Then the tree grows another crop of sprouts, and he in turn removes them. Thus the fight goes wearily on—the tree battling to re-establish an interrupted equilibrium on the one hand, and the man to enforce his ideals as to convenience or an aesthetic taste. Would it not be better to allow the old tree and dame Nature to have their own way a little, and put forth this wasted energy in the direction of producing fruit instead of battling with you.

How much then should we prune our bearing trees? No fruit tree with which I am familiar has so extensive and active a root system as the citrus. The roots have their function to perform. The leaves have theirs. One is dependent on, and co-operative with, the other. You cannot violently interrupt their relationship and dependence upon each other without defeating nature's ends, which in the case of a fruit tree is to bear fruit. Keep this point in mind, and let there always be a rational proportionateness.

My observation convinces me that heavy pruning does not promote the tendency of the remaining top to greatly increased productiveness. Hence, I would advise that sacrifice of large bearing low limbs be confined only to those which of necessity greatly hamper cultural operations or whose fruit will necessarily lie on the ground during the whole growing season, and thereby be ruined. The centers of trees should be sufficiently open to permit of free circulation of air and light.

Such growths as may congest and afford dark shade where insects may breed and harbor should come out. I do not approve of cutting out all the healthy interior small branches, for from them we gather our finest textured fruit. Of course all dead wood, to the last twig if possible should come off. Likewise all diseased wood.

In pruning for the elimination of disease or injury, such as may result from freezing or lightning, cut deep; see that you get beyond the injured part. Don't try to save a sickly growth that comes from a diseased limb, for you are losing precious time by so doing. Cut it out entirely and you will be aiding the tree to rapid recovery. You may be obliged to "stag horn" the tree or make a "hat rack" of it, but this is the short route to recovery.

Now I am going to say a little regarding the handling of the infant, or newly set grove. I anticipate we may have some in the audience who are inexperienced in this, and I hope these suggestions may prove helpful to them. What I have to say is based on sound logic and practical results..

We are accustomed to receive our young trees from the nursery completely deprived of top and foliage. The little infants have had pretty hard treatment in the ordeal of being taken from their cradle in the nursery and thus treated. But we are not through with our abuse of them, for we are going to set them out

in the barren field for the sun and drying winds to do their punishment.

Finally they are set out, and we begin in due time to look for the first indication of reviving life. Thirty, forty, even sixty days elapse. Finally to our delight the little growths appear! How intently we watch their appearance in greater numbers as the days go by! But to our dismay instead of five or six little branches coming out at the top of that little trunk, there is a multiplicity of them coming out all along its length down to the very bottom. And to our further disappointment, it seems as though many of the very best growths are from low down instead of at the top where we had pictured, and where we want the top to grow. Well, we have been told that these low sprouts must be rubbed off and so, though it most breaks our hearts, we proceed to do it. Oh yes, that's right. That's the way the nurseryman said to do, and of course he knows. Well surely he ought to. Of course you think by removing these lower growths you will promote the growth of the remaining ones. But that doesn't seem to be nature's way, and so, in reality you retard instead of hastening growth. Nature first tries to re-establish equilibrium. Get some top, or foliage to take care of the materials these little roots have begun to send up. Let that little tree have foliage as quickly as possible whether it is where you want it or not. Take care of that phase of the problem later.

My plan is to do nothing whatever in the line of pruning except to keep back such growths as may come from below the bud. All I would suggest that you do would be to go over the trees and loosely tie to the parent trunk two or three or even more of these stronger growths, simply to prevent the wind from breaking them off, or being broken off in hoeing or harrowing.

You will note that by the middle of the summer the most of the growth the tree is making is being made by these few stronger growths, while the lesser growths have ceased. You will note the large well developed foliage in the one, while in the other the leaves are poorly developed.

The following winter you will proceed to eliminate the original nursery trunk and begin building your top on the new, uninjured branches thus secured. The first winter you will be able to eliminate fifty per cent of the original nursery trunks. Of the remaining fifty per cent left until the second year you will see fit to eliminate ninety per cent of them the second winter. My experiences convince me that thus handled you will have larger trees at 5 years of age, than at 7 or 8 treated in the old way.

Grove Cultivation

S. P. Durrance, Avon Park, Fla.

The most important question in grove work is cultivation. This means not only after but also before the tree is set. It is very necessary that the land be prepared properly in order to get the best results from the grove. Therefore I would suggest that any one anticipating planting a grove, should first see that the land is thoroughly broken. In our lake region it should be broken to a depth of not less than eight to ten inches, especially if a disc plow is used. And I would recommend the disc plow because it does not turn the soil over but thoroughly breaks and turns under whatever vegetation there is on the ground.

Grove cultivation further means that you start right by setting the tree right, and the future of the tree depends much upon the setting. If a tree is set too deep or too shallow it will not do well. It is important to set the tree as near as possible at the same depth in the ground as it was in the nursery.

I will first discuss cultivation proper, beginning with the cultivation that it is necessary to give the trees during the first year. Some people think that a young tree does not need much cultivation, but I differ with them. I have had much experience along this line and I heartily recommend that young trees be given the same attention if not more than the older trees. It is a habit among some people to set their groves and give them a little plowing as the only cultivation, and, in many cases, this but once a year. This is a very bad mistake as considerable time is lost in not caring for the trees in the proper manner the first year. A young tree should have the same attention as an older tree.

It is not necessary to cultivate the entire middle between the trees while they are young, but it is very necessary that the trees be cultivated during the first year. The cultivation of a three-foot strip on either side of the tree with an Acme Harrow or cultivator of some kind is sufficient for that year. This should be done every ten to fifteen days beginning soon after setting and continue until November to keep the growth of grass and weeds down and to conserve the soil moisture. The middles may be allowed to grow up in whatever volunteer growth that may come, but to improve the soil I would recommend that velvet beans or peas be planted in these middles. Care must be taken of course if peas are planted to cut them early to prevent an invasion of the trees by plant bugs. In the fall, break out the middles and harrow down.

For the second year's cultivation I would recommend the clean cultivation of a strip from four to six feet on each side of the trees, but with a change in the direction of cultivation. If you cultivated in a north and south direction during the first year, cultivate in an east and west direction during the second year. This will allow the vegetation to grow in the middles where you cultivated clean the year before. One breaking of the entire ground during the year will be sufficient for both the first and the second year. Keep a clean strip around the trees durthe third year also by means of a six-foot or a nine-foot Acme harrow.

In the spring of the third year's cultivation the entire ground should be cultivated at least every ten days until probably the middle of May and oftener if you can possibly arrange to do so. I believe in thorough cultivation. If you are compelled to stint on anything do not let it be cultivation. I would much prefer one-half fertilizer and thorough cultivation than half cultivation and plenty of fertilizer. I have seen several nice groves grow up without very much fertilizer, but they had proper cultivation. As I stated in the beginning, cultivation is a foremost question in citrus growing.

I am a little surprised at myself for not having said anything about Natal grass before this, however I will speak of that a little further on. But should you have Natal grass in your grove it will be necessary for you to do more cultivating than with any other grass that I know of unless it be Maiden Cane.

Now I would like to speak of the depth of plowing in the fall of the third year. I would recommend from two and a half to three inches on our sand hill lake region country, but of course on the flat woods country you would have to use your judgment. Care must be used not to tear the large brace roots from the tree. One mistake that I believe is pretty generally made in the breaking of our groves in the fall of the year, is that of waiting too long for the cover crop to become ready to be turned under. I think that from four to five weeks after the grass has come to the hay stage is sufficient time to wait before turning it under and I believe that you will get better results from a humus standpoint if this is practiced. Now understand, I do not mean to turn this grass under green but possibly from four to five or six weeks after it has passed the water stage as stated above. This is more true should it be Natal grass, for the nature of the Natal grass is to continue to grow. After it has matured the first seed it sprouts from the various joints below and continues to do so until plowed up or sufficient cold occurs to kill it. In the section where I live we rarely ever have enough cold in the winter to damage this grass. This vegetation should be turned under in the fall and the same process as described above followed, which is to harrow or disk it down well. Should you have a warm winter and Natal grass in your grove you might think that you would get some rest from cultivation, but I doubt it. At least the same has not been my experience.

In the fourth year the cultivation in the spring should be clean and from tree

to tree. Cultivate late enough in the summer so that you will not have an extremely rank growth growing around the trees. If this should be the case, however, the hoe will be necessary. By the way I have not mentioned the hoe until at the present but do not think for a minute that we do not use the hoe. The hoe is one of the important tools for young tree cultivation.

Concerning the different kinds of implements. I would say in the fourth as well as the fifth, sixth, and seventh years and on during which the cultivation will be the same, I find that there is nothing that does the business any better and faster than the old Acme harrow. When it gets too rough for the Acme, use the Disc. The cultivation will be the same during these years with the possible exception that at least once every other year if not every year, I would recommend a breaking in the early summer, this plowing of course must be done rather shallow and if possible just ahead of our rainy season. This will give you an even growth of the grasses over your grove so that you may get an average hay crop should you desire to cut it.

Now I would like to discuss the planting of Natal grass in a young grove. I have seven hundred and fifty (750) acres of one to three-year-old trees in a grove in which Natal grass was from one side to the other. If I were planting a grove and thought it possible to keep it out I believe I would do so. However, I do not think this is possible as I find that Natal grass is now over much of the State, even in the woods as well as the fields. As you will remember I stated above that Natal grass quits growing only when killed by plowing or by cold. For this reason it is to some extent a very expensive grass as it feeds all the time. Now do not understand me to say that I dislike the Natal grass entirely, for we have fourteen head of mules on our grove and not one of these mules have had any other hay for nearly two years, and plenty of this hay is now in our barn to last us until we can cut more.

The presence of Natal grass in the grove will cause you at least one-fourth more cultivation, hoeing, etc., and it may cause one-third more. I am speaking from actual experience. Of course the Natal grass is a great deal more valuable for hay than any other common field grass, but I am almost persuaded to believe that as far as the citrus grove is concerned the grove would be as well if not a little better off if this grass had not been introduced into this section of the country. But say what you will, we have this Natal grass, I think, pretty well all over the citrus belt and we may as well prepare to handle and control it for if we do not it will control us.

I find that you can get from one to three cuttings of this grass a year and then have sufficient quantity left to turn under. We have a forty acre block in our grove from which I removed three cuttings last year and on the same acreage I made two cuttings the season before. I have not given these trees any extra fertilizer, excepting that last year I broadcasted about one hundred pounds of commercial fertilizer to the acre. This forty acres is just as good if not a little bit better than any forty acres in our grove. There-

fore I do not believe that from one to two crops of Natal hay taken from a grove is any drawback for, as I stated before, this grass will continue to grow and draw from the ground just the same whether you cut it or not and we might as well cut it and get some benefit. Relative to the value, I would just as soon have it as any other hay I have ever fed. Our mules eat it clean and hold up well.

Irrigation as a Grove Practice

F. E. Staebner, U. S. Department of Agriculture, Washington, D. C.

The object of irrigation is to supply needed moisture at times of deficiency. The result that we expect from irrigating a grove is to keep the trees in good condition, and to keep the fruit from dropping in dry times. As dry times are of irregular occurrence in Florida, there occasionally arises the question whether irrigation can be really profitable. An examination of the weather records for the last twenty-five years indicates that there have been periods of decided moisture deficiency in Florida in about one year out of four; and serious droughts that have resulted in considerable loss to citrus growers at least four years out of the last twenty-seven. As the harvesting of a good crop in a dry year often pays the full cost of installing an irrigation system, it would appear that irrigation is at least a cheap insurance.

The determination of the time to irrigate is readily told by the grower who is well acquainted with soil conditions in his grove whether he has irrigated before or not. To the man just entering the citrus industry the advice is to watch his soil conditions. It is not wise to wait until the trees show signs of drought, as citrus stock will not show lack of moisture until it has been long continued.

Probably irrigation should not be attempted during the winter dormant season, and not in the spring until the new spring growth appears, or all danger of frost is past. After that time irrigation may be practiced as frequently as the particular soil conditions indicate need of moisture. In this state rainfall will supply the needed moisture for an occasional year; most of the moisture for a good many years; and a decided lack of moisture only once in several years, so that only occasionally will the irrigating plant be brought into frequent service. But probably irrigation will show a profit about half of the years.

Physical conditions of the irrigating plant have tended, in the past, to limit the amount of water that could be applied in one irrigation. New irrigation plants should be installed with a capacity of at least one inch of water over the entire tract if from a spray system, or double that amount if from a furrow or flooding system, to meet Florida conditions. Further than this, the best practice seems to indicate that reasonable rapidity of irrigation is desired, and that no plant that takes over ten days to cover a grove can possibly be considered successful.

As irrigation practice is so dependent upon the irrigating plant, a few words about plants are necessary. The principal point, of course, is to deliver the water to the tree roots. Florida soil con-

ditions practically prohibit the use of open ditches—the simplest of all systems. By a slightly more advanced system, water may often be delivered to the tree roots with the use of terra cotta mains and sub-mains and run the remaining short distance to the trees in furrows along the middles; or under more exacting conditions, may be brought to the trees themselves with light movable slip-joint pipe. Such a system would be designated as a "low pressure" system, as the terra cotta mains and sub-mains are always under some pressure though that pressure must be small. About two inches in depth of water should be delivered at each application with this system. Such a system is installed at a relatively low initial cost, but some labor is always necessary in irrigating either to properly handle the water furrows or to move the sections of slip-joint pipe.

The next more elaborate system is the so-called high-pressure or spray system. Few such systems have been installed lately owing to the high initial cost, which would average from four to eight times as much as the corresponding low-pressure system. These systems are more economical of water than the others, and about one inch in depth gives a satisfactory irrigation. With such a system water is delivered through iron pipe, mains and laterals, and directly to the trees through stationary spray or rotating nozzles. A common practice is to attach the nozzles to the iron pipes by means of flexible hose and thus move the nozzles from place to place. This, of course, requires some labor. Some systems have the nozzles directly attached in a fixed position to the iron pipes and in these labor is reduced to a minimum, requiring only the opening and closing of a few valves. As mentioned above, such systems are very expensive, and for most Florida conditions a low-pressure system gives satisfactory results with a materially smaller investment.

Spraying Machinery for the Citrus Grove

E. H. Favor, Horticulturist, Galva, Ill.

There is no question as to the dollar and cents value in spraying. In the citrus groves in Florida spraying is just as important an operation and has as much to do with the production of high class fruit as it has in the peach orchards of Georgia, or the apple orchards of New York or Oregon. True enough. this situation has not always existed. There was a time when spraying was not so important or so necessary. Natural parasites could be relied upon to keep under control some of the important pests, and they did their work well. Then too, market requirements were not so rigid, and competition not so keen.

Markets are becoming more and more exacting in their demands. The consumer has been encouraged more and more to purchase an article by its looks rather than by the actual quality or merit contained within the article. Since citrus spraying is very largely concerned with improving the exterior of the fruit, its importance is manifest most emphatically when the buyer comes around, or when the fruit reaches the market. The fruit that is bright and clean, fruit that possesses a handsome golden color all over and is not defaced by any conspicuous discoloration, will sell on its appearance. Little does the consumer know of your oranges as Lue Gim Gong, Parson Brown, Pineapple or Valencia. To the consumer an orange is an orange. Some have an attractive, appetizing, golden color while others are a dirty brown. Some are known as "Sealdsweet" and other advertised trade names, while others are not. Some can be bought at three for a quarter, while others cost "two bits" a dozen. The difference in most instances is largely a matter of spraying.

This winter, after spending several pleasant weeks among Florida groves, I acquired a remarkable appetite for the sweet and juicy Florida grown oranges. Upon my return North, I endeavored to buy Florida oranges in my home town. All that were available were miserable, russeted, ammoniated fruits. Fruit that in appearance possessed nothing that would induce one to buy. Along side of these Florida oranges were piles of Western grown Naval oranges of wonderful appearance, just as bright as could be desired and possessing a very tempting appearance. I stood for a moment contemplating which I should buy—those of the perfect appearance and with a flavor I knew I would not like, or should it be the sorry looking fruit, from the Indian River country which I knew I would find to be sweet, juicy and delicious.

I asked the fruit-stand man which kind

of fruit sold the best and was not in the least surprised when he told me that the bright clean fruit sold best, except to those who knew what was inside the skin of the Florida grown fruit. He said if the sweetness of the Florida orange could only be put inside the skin of the Western fruit, it would outsell the Western fruit, three to one. When I told him it could be done; that by proper spraying Florida growers could produce fruit with a perfect exterior and an unequaled interior, he said—"well, if I was you I would go down to Florida and never stop talking sprayers until I had every orange man spraying all the time."

I mention this little experience with a small town fruit dealer in the North just to indicate to you that bright fruit has a demand and that by producing bright fruit, your sales and profits will increase.

To produce such fruit is a business matter. Markets cater to the desires of the customer and you, as producers, must get into rank sooner or later of catering to the likes of your ultimate consumer by supplying him with fruit of as high quality inside and out as it is possible to produce.

The spraying machine properly used is the means which will enable you to obtain the highest quality in the appearance of your fruit, and it will be my purpose in this paper to present a few facts about sprayers for the Florida grove which I have picked up through observation and experience.

Spraying is the application of a solution to the foliage, fruit and wood of the plant for the control of pests that attack it, and for most satisfactory results and greatest economy the solution must be in the form of a mist. The more finely divided this mist is, the better it spreads. There is a reason for this, aside from the standpoint of economy. A mist will cover and wet the foliage without running off. A bucket of water may be dashed into a citrus tree, but will wet only a small portion of the foliage. If the same bucket of water is applied with a gardener's sprinkling pot, a greater area of the leaf surface may be covered and more will stay on the tree because the solution is more finely divided. Again, if the same bucket of water is applied to the tree with a sprayer, a still larger surface may be wet because of the fineness of the drops and with a still smaller loss from dripping. This is because the spraying machine has broken the water up into small drops, which have adhered to the leaves.

We are familiar with the wetting of grass by dew. The minute drops of dew adhere to the foliage because the bulk within the drop, does not have sufficient weight to break the surface tension.

In spraying it has been found that the more finely divided the solution can be made, the better it will cover the foliage with a minimum of dripping. Dripping is undesirable, as all of the solution that drips from the tree on to the ground is a total waste. Two things are essential to obtain a finely divided mist. One of these is a nozzle of the proper construction, the other is adequate pressure behind the solution.

The modern disc nozzle, such as is

used on practically all sprayers today, has had an interesting development and been evolved through a long period of years and tireless experimenting by practical orchard men and mechanical engineers. In its present form the disc nozzle is a splendid bit of mechanism that will deliver in a mist form any solution that passes through it under pressure. It is a well known fact that as the pressure is increased the modern disc nozzle causes it to break into a finer and finer mist and with a better penetration of the spray. That is, as the pressure is increased, the spray has more force behind it and floats to a greater distance from the nozzle.

The question then arises as to what is the most desirable spraying pressure. As a matter of fact, this cannot be answered definitely and with equal application to all sizes of sprayers, but it is sufficient at this time to say that careful investigation has shown that a maximum atomization of the spray is obtained at a pressure of about 300 pounds.

But not all sprayers are capable of producing 300 pounds pressure. A hand-operated sprayer, for example, cannot be operated many minutes in succession at a pressure much higher than 125 pounds, and a hand sprayer is a necessary machine in young commercial groves and bearing groves of three or four acres or less.

It is indeed, unfortunate more people in Florida who have small plantings of citrus fruit trees do not make use of hand-operated sprayers, of which there is a very large variety obtainable from almost any hardware, implement or fertilizer dealer.

The hand-operated sprayer, no matter whether it is intended for use in a bucket of spray solution, or whether the sprayer is a large size, two-cylinder affair, operated by a powerful lever, should be in the hands of every Floridian who raises citrus fruit on a small scale for home use or for market Such spray pumps when equipped with a disc nozzle of such size that will enable the operator of the pump to work it at the highest possible pressure, and used with the right material, at the right seasons, will enable more Florida growers to produce fruit of very much better appearance and larger size. I urge every person in Florida who has one or more citrus trees to get a sprayer and to use it. The beautiful little cities of Florida would have a far more attractive appearance if the citrus trees in the back yards were sprayed. It should be a matter of civic pride, if nothing more, to have the little home grove well sprayed.

During the tourist season a very much better impression would be created if the back yard and vacant lot citrus trees were loaded with clean, bright oranges and grapefruit, rather than the russeted, discolored, scale-infested fruit that I saw in so many places this past winter.

I can not refrain from this appeal to the men with a few citrus trees, to get a sprayer and to use it with the right material at the right time.

The commercial grove owner who has a grove of three or four acres or more, will find a power sprayer much more

economical in operation than a hand outfit. A power sprayer will not only maintain a steadier and higher pressure in the pump, but will release the labor for the hose lines.

While there are a great many different makes of power sprayers, those which have proved most serviceable for the work of spraying citrus trees, are those which are built to produce as fine a mist as possible. The economical operation of the sprayer in the commercial grove is a more important item than in the home grove, since the spraying in the commercial grove is done to make money. On this account, the efficient operation of the sprayer engine, the ease of getting repairs and service on the engine, and the maximum atomization of the spray, are of prime importance.

The commercial grove owner will readily appreciate the effect of the spraying pressure on the efficiency of his work.

Since the normal working pressure of different makes of sprays ranges from 150 pounds upwards, I wish to discuss three graphs, showing something of the effect of pressure on the atomization of the spray.

The graphs were made in a special device which enables one to obtain a cross-section through the spray cone at any point. They were made with the same nozzle, same distance from the nozzle, but with pressures of 100 pounds, 200 pounds and 300 pounds, respectively.

To fully see the difference between these graphs, they should be examined at close range.

Graph No. 1 was made at a pressure of 100 pounds. You will notice that drops of spray form a ring and that the majority of the drops will average in size about one-sixteenth of an inch in diameter. The center of the ring appears to be practically bare, but if you could examine it with your lens, you would see that it is specked with very fine drops.

Graph No. 2 was made at a pressure of 200 pounds. The drops making up the ring are not so large as in graph No. 1 and the center contains a much larger number of the extremely fine drops.

Graph No. 3 was made under a pressure of 300 pounds. Here it will be observed the ring of large drops is gone and all that remains is an area, so thickly covered with extremely fine drops, that the surface is almost entirely covered, but with no evidence of dripping.

In the case of graphs Nos. 1 and 2, when the foliage has been wet all over with drops as large as these, the drops will run together, drip to the ground and be wasted. But in graph No. 3, it will be observed the extremely fine drops have actually covered the entire surface in patches. From this it is self evident that such a spraying pressure will permit the operator to obtain a better spread of the solution than when the spraying pressure is not high enough to break up the solution to its highest degree.

When a high pressure power spray is used, better service can be obtained from the labor-saving device known as the "Spray Gun." The efficiency of the spray gun is greater where the trees are tall and where it would otherwise be necessary to stand on top of spray tank to reach the tops of the trees. The spray gun is a large capacity nozzle and constructed

in such a way that spraying may be varied from a narrow-angle, long-distance spray for the top trees, to a wide-angle, short-distance spray for the low branches. To obtain the best results with the spray gun and high pressure, a large capacity pump is necessary and one man can use the entire capacity of a large power sprayer when operating the gun.

Spraying is an expensive operation. Aside from fertilization it is the most expensive part of grove management. It is expensive not only because of the cost of the spray materials, but also from the cost of labor. It is, therefore, essential that the sprayer have the highest possible working efficiency, both in the atomization of the spray and in gallons per minute. When this prevails, the spraying cost will be reduced to the minimum, in so far as the machine itself is concerned.

It has been my observation that the great majority of fruit growers, when buying their sprayer, particularly their first sprayer, consider their purchase entirely from a standpoint of how much money they must pay for the machine, rather than how much money the sprayer can make or save for them. The earning power of the sprayer is seldom considered. Yet it is the earning power of the machine that determines whether or not a machine that costs $500.00 may not be more economical to buy than a machine that would cost only $200.00.

This phase of spraying machinery for the citrus grove constitutes a big subject in itself. But as I have already consumed more than my share of your kind attention, I must pass it for the present, and give way to the next speaker.

Machinery in the Grove

W. E. Sexton, Vero, Florida.

This is the first time that I have had the opportunity to attend one of your meetings, and I know very few of your people. I have heard of many of you. I know Mr. Inman. I know he has met with you many times and knows practically all of you. He admitted when he got up here that he was scared. I will admit the same thing. I don't know who arranged these flowers around here; they are beautiful, but I would more appreciate a desk standing here that would kind of hide my knees which are shaking a bit. I remind myself a little bit of a colored man down at Vero, who joined the army, and had come back. One morning I picked him up in my truck. I said, "Johnson, did you get over to the other side?" He said, "Yes." I said, "What did you do over there?" He said, "I tended the mules." I said, "What do you mean by that?" He said "We had a camp and had our mules thirty miles back from the battle front. We had two divisions; part of them carried the mules up fifteen miles, and turned them over to another set of men, who carried them on up to the front." I said "Which division were you in? He said "I carried them up the first fifteen miles." I said "Weren't you sorry you didn't get to take them on? You were not scared, were you?" He said, "Mr. Sexton, I was so scared that every morning when I looked at the paper, I expected to find my name in the casualty list." So that is the way I feel. I am now here in this state, and I have observed you and the things you have been doing. I feel rather timid in talking to you and telling you anything about what I know, and suggesting anything that you should do, because I have only been in your state five years; and I have lived in it permanently only two and a half years. And anything that I might suggest, especially along the line of citrus culture, I expect to be taken with a grain of salt, because you men who have made a success can imagine about how much you knew when you had been in the business only two years. That is about what I know.

I have a little grove of my own over at Vero of which I am not proud, because it does not suit me. Last year I set eight thousand trees. This year I set about six thousand more. Some are looking all right; some are not. I have a lot to learn about citrus culture, and if Mr. Floyd had asked me to talk about citrus culture, I would not have talked to you. But he asked me to talk to you about farm machinery. Since I

was born on a farm up in Indiana, and graduated from an agricultural school, and afterwards took charge of a big farm that had four tractors on it, and later on acted as the the Agricultural Agent for the Spaulding Machine Company, that sent me in all the states east of the Mississippi River, and West as far as Texas, I felt that I might be able to say something about machinery which might interest you. So I told Mr. Floyd that if he would let me talk about tractors that I would say something.

I feel so strongly about tractors that I am like a young man that went to California. He was filled with the wonders of that country. He got so enthusiastic over it, he decided he wanted to sell land. He came back East and settled in a small town, and after he had been there a while and learned a few of the people, one of the old gentlemen of the community died. The minister who was preaching the funeral got up and said that since he didn't know much about this man, he would tell what he knew about him, and afterwards would call upon the people who knew the man to get up and say a word. He waited for a long time, and no one got up. This young man who was in the crowd, arose and said: "Ladies and gentlemen, I have only been here a short time myself; I don't know much about this man. He is a fine man as far as I know, but if no one else is going to use this valuable time, I am going to say a word for California." So I am going to say a word about tractors, and I am going to talk confidentially to you people.

We had a little get-together meeting over in our town the other night, and one of the men got up and said, "I want to talk to you a little bit. We have got a get-together meeting here, but did you know that fifty per cent of our people are knockers? But," he says, "that don't need to worry you any, because ninety per cent do not like the place they came from, or they would not be here." I am going to knock the tractor a little bit, but I like it. I have a few notes here that my wife wanted me to write three weeks ago, but I waited and wrote them this morning.

I am going to ask a few questions first. Mr. Warren, our Agricultural Agent in St. Lucie County, is going to gather a few statistics here for me.

First, I want to know how many men in this audience either own a tractor or have owned one. (Number of hands raised.)

I want to know how many men own two tractors. (None).

I want to know how many own three tractors. (None).

I want to know how many men in this audience own a Ford car. Hold up your hand. (Number of hands raised).

How many of you are satisfied with your tractors? (One man stated that he was).

Now I want to know how many of you feel that you got as much for your money when you bought a tractor, as you did when you bought your Ford car. (One).

When I was selling plows and demonstrating Spaulding tilling machines, I traveled out of Cleveland, Ohio, and there was another man who traveled out of Ohio, and we got down South. When

he was down South he was always telling the people about what he was doing on his farm in Ohio, and when he was up in Ohio in the summer time he was always telling about the things he did on his plantation down in Georgia. He got along with that fine until one day up in Ohio, he was telling some big things about his Georgia plantation, and one man in the audience, who was a Georgia Cracker, said "Stranger, I came from that very town; I never heard of your farm." That taught him a lesson. Afterwards when he went to address an audience he always said "How many live in Georgia?" If no one said they lived in Georgia, he talked with ease; but if they did, he restricted himself. Now I know what I am going to encounter.

I am not selling tractors, and I am not going to say which is best. I am going to treat them all as one class. I have had experience, and my first experience was with an old Russell tractor; then I had three Holt Caterpillar tractors under my management. I also had a Kelly Springfield Road Roller, and I was continually having to take the roller and pull my tractors out, but I never had to take my tractor and pull the roller out. I have had a Hughes, a Sandusky, an International Harvester and a Chase tractor, so I feel that I have a little opinion about tractors. There are so many men paid by these tractor companies to tell all the good things about them, and to cover up the bad things, that I am afraid that we farmers might overlook some of them. So I am going to tell you what I think about it, and if you want to say anything about it, we will talk these things over, and maybe they will listen to us a while. We sent a resolution up to Tallahassee to the State Legislature today, and they are going to listen to us. The tractor men ship the tractors down to us, and the men come down and tell us a few stories and try to make us feel good. But we still have the same troubles that we had before.

After all of my experience—I had been away from this tractor business for two years and had a lot of work I wanted to get done—a salesman, a Swedish fellow, got hold of me and wanted to sell me a tractor. A fine old gentleman who lives in my community, and had a tractor, said it was good. I went over and looked at it and I wanted it. I prevailed upon my partners in business to give me money to buy it with, and I bought it. I paid him $1,040.00 for it. You may think I am prejudiced against tractors and favor mules. I am not satisfied with mules either. After I paid him, the repair parts and the labor on this machine cost me $343.87, making a total of $1,383.87 that I had paid out. I kept on trying to work this tractor. I worked that tractor just 587 hours. With a cost of $194.30 for lubricating oil and gasoline that I used on it, my tractor stood me $1,578.17 as the total cost, at the time I decided I could not afford to bother with it any more. I felt so mean that my wife couldn't live with me, and I decided I would rather throw it away and forget about it, and when I did that is what it had cost me.

I had plowed forty acres of land and disced seventy acres; had had four men operating it; they were all good men. I

gave them a credit of $6.00 an acre for plowing the land, because that is what it costs to plow new land down there with mules, and $3.00 an acre for discing it. I had, as results from that tractor, $450.-00. It cost me $1,578.00, leaving a balance of $1,128.17 as loss on my tractor, and I hated it just as bad as the tractor man hated it.

My partner kept complaining about it all the time, and I wrote the Company and tried to get them to come down and help me. They said, "what model is your tractor?" I said "Model B." They said "We have decided that tractor is all wrong; we have a new type now, Model E." I said "I am your experimental department, eh?" They didn't like that. They said "No, we put these tractors out, and we will help you through. We will send you the parts and help you fix it up." I had three of their men there, but they had a telegram from some other place to rush on to a more important place, and they left me. I kept cussing about it and threatened to put up a sign on this tractor, near the Dixie Highway, "For trade for any other known make of tractor." I talked to this Swedish man—he is still the agent for them—and he said this Company had sold out, and was going to come around and give us till June of this year to have an adjustment on the old tractors, and he said they would allow me $400.00 for this old tractor, on a new one. If they do give me credit for that, that will leave me $728.17 in the hole yet. That is my experience with tractors. I am still for them. I think they are good things—the finest things a farmer ever had, but I have got a few things I am going to close my remarks with, and then if you people don't agree with them, you can tell me what you think about it.

First, too many tractors are made to sell, and not to give service. I think you will find that is true, if you talk to these men confidentially.

Second, the material used in most of these tractors is not strong enough to stand the work that it is intended for.

Third. Most of the tractors are unwieldy, and not fit for the work which people are making them do. This is brought about by the tractor people trying to make their tractors fit universal conditions. They send some to Florida that they would not think of using in Illinois or Indiana. They will send you a tractor right now and try to make you think that it is just the tractor that you want. They try to make one tractor fit universal conditions, and it is not possible.

Fourth. They charge too much for parts that we farmers expect to do the experimental work with which we are doing.

I say this in full fairness to the tractors, as I am a believer in them, and I think that we should talk these things over in such a way that in the end we will get a better product for our money. If any of you want to ask any questions I will attempt to answer them. If there are any tractor men here, I am glad of it, because they will try to get a show at me, and if they will come over home with me and operate my tractor successfully, I will give them $100.00 right now. I think it is time we men were getting

the same value for our money when we buy a tractor, as we do when we buy a Ford car. I have two Ford cars, and I generally come in with them, but my tractor is always causing me trouble.

Question: What tractor do you recommend?

Mr. Sexton: If I should recommend any tractor, I would want to go to your land and look it over carefully and know exactly what you are going to do with it.

Question: I want it in an orange grove.

Mr. Sexton: Are the trees large?

Answer. Yes.

Mr. Sexton: I am going to tell you something now that will be very valuable to you. You noticed I never said anything about the Cleveland tractor. I have never used that. I would advise you to study the Cleveland tractor. I am just now considering buying one of them. It looks good, and I think maybe it is all right.

Question: Mr. Sexton, I have no question, but I was on the point of congratulating you that you had no Cleveland tractor in your collection.

Mr. Sexton: I will say this about the Cleveland tractor. There is one thing that I didn't mention; that is, the manufacturers of the tractors themselves universally forget the comfort of their operators. Take your Cleveland tractor and drive over a rough road with it for ten hours, or over a bumpy field. It has a spring seat. You don't know whether you are going out or staying in. The comfort of the operator needs to be considered more than it is now.

Question: How about the Beeman tractor?

Mr. Sexton: I would not say much about it, because it is young, like I am, and I haven't heard much about it, but my partner wants one. He lives in town, and he tells me a lot of things to do some times, and I tell him that his office management doesn't apply down here with these Florida conditions. I have not tested it out yet.

The Refrigeration of Fruit and Vegetable Shipments

A. W. McKay, U. S. Bureau of Markets, Orlando, Florida.

There is probably no factor which has played a larger part in the development of the fruit and vegetable industries of the country than the refrigerator car. Though it is true that a considerable percentage of the fruits and vegetables grown in this state are shipped under ventilation, nevertheless without the refrigerator car the market for many of our products would be restricted to nearby points, while others could not be marketed at all. Admitting the important part which the refrigerator car has played in extending the marketing area and encouraging the production of fruits and vegetables, it must also be granted that inadequate refrigeration and poor refrigerator cars have caused enormous losses of perishable food products. All growers and shippers, vegetable shippers especially, know of shipments which arrived at market with the bottom of the load in good condition, while the top showed serious decay or other deterioration. When a shipment, uniform in condition when loaded, arrives at market in this condition the unfortunate limitations of the average refrigerator cars are, as a rule, responsible for the damage.

The serious proportions of the losses due to inadequate cooling, or to frost damage in transit, led the United States Department of Agriculture to undertake an investigation of refrigerator cars and refrigeration practices. This work was begun in California four years ago. It has been carried on in the West, the Southwest and East with a wide range of products and types of cars. This season experiments of the same nature have been conducted in Florida.

Briefly, the plan of the investigation has been to secure accurate records of the temperatures of a large number of shipments, loaded in cars of varying design and efficiency. These records are secured from the time the cars are loaded and the doors closed until they are opened at destination. By the use of specially constructed electrical thermometers it has been possible to obtain temperatures in twelve selected locations in each car without opening the car doors at any time or disturbing the normal conditions of the shipment. In all cases our men accompany the cars under test from the loading station to market. In the past four years several hundred trips of this kind have been made with from three to fifteen cars under observation in each test. I wish to emphasize the fact that the temperatures on which our conclusions are based are

not the temperatures of the air surrounding the packages, though air temperatures have been secured in every car tested. In a shipment of oranges, for example, we obtain a temperature of a particular orange in a box located in a particular part of the car. This temperature is combined with others secured in boxes so located that the average of all will be very nearly the average temperature of the entire load.

The results of this work have been accepted by many railroads and car lines, and practically all refrigerator cars built since 1916 conform closely to the designs advocated by the Department. The Railroad Administration, in preparing plans and specifications for a standard refrigerator car, adopted all of the improvements which this work has demonstrated to be of value. There are now approximately 5,000 cars in the United States which conform entirely, or with only minor variations to the specifications of the U. S. Standard refrigerator car. I believe that practically all refrigerator cars built in the future will follow this standard, and that the older cars will be rebuilt according to standard designs as rapidly as they can be put through the shops.

Before going into details regarding the special features of the standard car, and the performance of this and other types, I wish to discuss a few of the elementary principles of refrigeration. There is a great deal of misapprehension, perhaps it would be better to say lack of comprehension, regarding the manner in which a refrigerator car actually cools its load.

In the first place, we are obliged as you know to depend on ice as the refrigerant for perishable shipments. Mechanical refrigerating plants for cars are still in the experimental stage, and are not yet sufficiently simple or fool-proof to be practical. Contrary to a rather common belief, refrigeration is not obtained from the ice in the bunkers of the car. The cooling effect,—the absorption of heat,—is secured by a process analagous to the burning of coal to produce heat. The coal bin may be full of coal, but the coal cannot produce heat until it is burning. Similarly the bunkers of a car may be full of ice, but no cooling is produced until the ice is melting. Each pound of ice in the bunkers will absorb a certain quantity of heat while it is melting and no more. Consequently nothing can be done to increase the refrigerating value of the ice. and the problem resolves itself into one of transferring heat rapidly and uniformly from all parts of the load to the ice.

To do this, we are dependent on the natural circulation of the air in the car. The use of fans is open to the same objection as are mechanical refrigerating plants. One of the first laws of physics is that warm air will rise and cold air fall. This is the elementary principle which must be kept in mind in the design of refrigerator cars. The problem is to provide unobstructed channels for air circulation, together with a sufficient quantity of insulation in the car walls to keep leakage of warm air into the car at a minimum.

In a refrigerator car there is a column of cold air in each bunker, and a column

of warmer air in the body of the car. As the air is chilled by the ice it falls to the bottom of the bunker, displacing an equal volume of air already cooled, which is forced out through the bottom bunker opening. The cold air passes lengthwise of the car through the spaces between the crates, absorbing heat from the packages with which it comes in contact, and gradually rises to the ceiling, returning to the bunker through the top bulkhead opening. It is readily seen that this circulation is necessarily slow, and that the air is easily checked and retarded.

In the ordinary refrigerator car there are several obstructions to air circulation which makes cooling of the load a very slow and difficult process. In the first place the bunkers are filled with ice, leaving very little space which the air can penetrate. Secondly, the shipment is loaded on the floor of the car in a more or less solid mass. With some packages, such as hampers and baskets, it is impossible to secure a compact load, which will stand the shocks and jars it receives in transit, and at the same time provide channels between the packages for air circulation. It is possible to provide proper air channels in a load of crates, and if the load is securely stripped and braced these spaces will remain unobstructed throughout the trip. Often, however, a careless workman will load the crates out of line so that all or part of the air channels are blocked; or the load will shift in transit with the same result. When this condition arises, it is absolutely certain that the temperature of the load in the center of the car, beyond the obstruction, will be five to ten degrees higher than would have been obtained with a properly spaced load. The first requirement for quick and uniform cooling, therefore, is good loading. A shipment well loaded in a poor car may refrigerate as rapidly as a shipment carelessly loaded in a good car.

Another factor which influences the promptness with which a shipment is cooled is, of course, the initial temperature of the product. This can be controlled by the shipper to a limited extent. For example, you have a carload of fruit on the floor of your packing house, the temperature of which is, say 55 degrees F. at 9:00 a. m. If that fruit stands in the house until the afternoon it will warm up under normal conditions to 65 degrees F., or higher. If it is then loaded into an iced car, its average temperature will not be lower than 55 degrees F. 24 hours later, whereas if it had been loaded at 55 degrees at nine o'clock in the morning, its average temperature 24 hours later would be well below 50 degrees F. In other words, you would substract a day from the time necessary to cool this shipment by loading it promptly while the fruit was at a relatively cool temperature.

I have already mentioned the obstruction to air circulation caused by the mass of ice in the bunker of an ordinary refrigerator car. To overcome this difficulty what is known as the wire basket bunker was tested and recommended. This is not a new device, it has been used on a few cars for twenty or twenty-five years. In the wire basket bunker the ice is held away from the four walls by a heavy wire screen, providing a two

to three-inch air space, which permits air circulation on all sides of the ice. The advantages of this type of bunker are very plain; first, the quantity of air passing over the ice in a given time is increased and the cooling of the load accelerated; secondly, the air comes in contact with a larger surface of ice and is more thoroughly chilled.

The second feature of car construction to be modified was the bunker bulkhead (the partition between the ice bunker and the loading space of the car.)

In all parts of the country, except the Southeast, refrigerator cars equipped with an open type of bulkhead have been in most common use. These bulkheads are constructed of heavy wooden slats, spaced about an inch apart, or of curved metal louvres, as in the so-called syphon bulkhead. It was found that the open bulkheads do not give uniform air distribution. A portion of the air escapes from the bunker before reaching the bottom of the ice. It then travels through the load perhaps only the distance of two or three packages before returning to the bunker. In other words, a part of the air is short circuited, and the packages in the center of the car are inadequately cooled in consequence. It was found also that with the common type of solid bulkhead, the packages immediately against the bulkhead are cooled rapidly by conduction. This results in a patch of stagnant air at the top of the load next to the bulkhead which interferes with air circulation.

To overcome these difficulties, a solid insulated bulkhead was introduced. It is insulated to prevent the rapid cooling of the packages adjacent to the bulkhead with consequent interruption of air circulation. Being solid it forces the air to the bottom of the bunker before it can escape into the body of the car. The results are (1) complete chilling of all the air, (2) more air reaching the center of the car, and (3) the elimination of stagnant patches of air caused by the premature cooling of the crates next to the bulkhead. The insulated bulkhead is provided with openings across the top and bottom, which as a rule are 15 and 12 inches high, respectively.

Another feature of bulkhead construction modified was the splash board, that is the wooden or metal strip running across the car, underneath the bottom bulkhead opening. In most of the old style cars the splash board is at least 4 inches above the floor level, and seriously obstructs air circulation. In the newer cars it has been reduced to 1½ inches, and in some types, by sinking the bottom of the bunker below the floor level, it has been possible to do away with the splash board entirely.

Following the improvements in bunker construction, described above, there still remains the problem of providing a passageway for the air into the center of the car. This has been accomplished by the introduction of floor racks, that is a slatted false floor, built of 2x4 inch stringers placed lengthwise in the car, and 1x3 cross strips, spaced 1½ inches apart. In the standard cars the floor racks are a permanent part of the equipment, and are hinged to the car wall so that they may be raised when the car is cleaned or when heavy dead freight is carried.

The racks provide a clear four-inch air space underneath the entire load, and with the bunker improvements already described, form a combination which will produce as prompt and uniform cooling of shipments in transit as can be obtained under present conditions. They remove most of the objections to hampers and baskets from a refrigeration standpoint, and with a shipment in crates supplement, in fact make almost unnecessary, the provision of air spaces between the packages. If we were allowed only one improvement in our present refrigerator car, I would unhesitatingly choose floor racks as the most indispensable.

From our discussion of air circulation, it will be seen that cooling in the ordinary refrigerator car proceeds under difficulties similar to what would be encountered if an attempt was made to drive an automobile with all the brakes set. The wire-basket bunker removes one obstruction; it releases the emergency brake. Floor racks release the service brake and allow the machine to proceed smoothly and rapidly.

The next essential of an efficient refrigerator car is adequate insulation. The general run of cars have from one half to one and a half inches of insulator. An inch is about the average. The work of the Department of Agriculture has shown that refrigerator cars must have the equivalent of three inches of cork in the roof, two inches in the walls and 2½ inches in the floor. Hairfelt, or similar materials can be used to advantage in the walls and roof, but it seems necessary to use cork in the floor for the reason that special precaution must be taken to keep the floor insulation waterproof. The above specifications, as you see, call for more than twice the quantity of insulating material used in the ordinary refrigerator. This amount is the absolute minimum which will protect shipments from the invasion of heat under all conditions, and which will afford a degree of protection from frost during the winter months at all consistent with safety. Shippers of pre-cooled fruit are especially interested in securing well insulated cars, for a large part of the benefits of pre-cooling may be dissipated by a poorly insulated or leaky car.

Briefly, then, a standard refrigerator car, one that will cool its load with reasonable promptness, and protect it against the elements, must possess the following essential features:

1. Wire-basket bunkers.
2. Insulated bulkheads.
3. Floor racks.
4. Adequate insulation.

It must not only possess these features when new, but the car must be kept in first class condition by frequent inspection and repairs, and by the rebuilding of the entire car body when light repairs will no longer suffice. Cars in poor repair cannot give efficient service, no matter what desirable features they may contain.

The cooling of a perishable shipment in transit is a slow process in any refrigerator car. In the ordinary refrigerator car cooling is so retarded, especially in the top layers of the load that it is usually several days before a desirable temperature is reached. This may be illustrated by a table showing the tempera-

tures in a car of oranges shipped from Florida to Baltimore, Md., under standard full tank refrigeration Feb. 19, last.

Table 1. Average temperature of the top layer and entire load in a carload of oranges shipped under standard, full tank refrigeration:

	Average of Top layer	Average of load
Immediately after loading	61.4°F.	59.6°F.
One day later	59.2°F.	50.3°F.
Two days later	56.8°F.	48.3°F.
Three days later	53.1°F.	46.0°F.
Four days later	50.8°F.	44.7°F.
Five days later	48.7°F.	43.3°F.

It will be seen from this table that the temperature of the top layer dropped only two degrees in 24 hours, and less than five degrees in two days. Four days after the car was loaded the temperature of the top layer was still above 50 degrees, and the average of the car was practically 45 degrees. In fact the shipment had hardly reached a desirable temperature five days after it was loaded. This slow cooling is not an exception, and is not found in the cars of any one company. It is the common experience with shipments transported in any of the old style refrigerator cars.

With the standard cars much more rapid cooling is obtained, especially in the top of the load and at the doorway where most of the trouble is experienced. The advantages obtained vary with the initial temperatures of the shipments, with outside temperature conditions, and the nature of the package used. I can safely say, however, that with fruits or vegetables loaded in hampers or baskets, at a moderately high temperature, the standard car will cool its load a degree an hour faster for the first six or seven hours than will an old style car with a similar load. Twenty-four hours after loading, the average temperature of the load in a standard car loaded with any style of package will be five to ten degrees lower than the average temperature of an ordinary refrigerator with a similar load, provided the shipments were at the same temperature when loaded. The difference between the top layer temperatures will be greater, probably over ten, sometimes as much as fifteen degrees. The higher the initial temperature of the shipment the more pronounced becomes the comparative efficiency of the standard car. The condition of the shipment on arrival is often a more striking indication of the value of these improvements than is the temperature difference obtained in transit. I recall one test made from the Imperial Valley, California, with cantaloupes two years ago, in which two cars, one conforming very closely to the requirements of a standard car and the other an old line car in rather poor repair, were loaded with melons of the same general condition and quality. The melons arrived in New York with 86% of the top layer crates in the old car soft and undesirable from a market standpoint. Less than five per cent of the melons in the top layer of the standard car were soft. In other words, the deterioration had been reduced to less than one-seventeenth of that obtained in the line car. Equally striking examples have been obtained with other products, from other sections of the United States.

The Department of Agriculture has also conducted experiments to determine the practicability of using salt to hasten cooling in transit. It was soon discovered that adding salt to the ice in a refrigerator car of the old style was of no value, and that freezing of the product at the floor close to the bulkhead was liable to follow. With air circulation obstructed as it is in the ordinary car, the only effect produced by the use of salt is a chilling of the crates nearest the bulkhead without the temperature of the load in the center of the car being affected in any way.

With the standard car, however, a fairly high percentage of salt may be added to the ice with safety, and cooling of the load will be greatly accelerated. Aside from pre-cooling, the use of salt with a properly constructed car furnishes the most rapid and effective method of cooling perishable shipments. The following table shows the average temperature of the top and of the entire load in a shipment of oranges in a standard car with the ice salted. This shipment was sent from Florida during the past season. 800 pounds of ice cream salt was added immediately after the car was loaded and 200 pounds at the first re-icing.

Table 2. Average temperature of the top layer and of the entire load in car load of oranges shipped in a standard car under standard refrigeration:

	Average of Top layer	Average of load
Immediately after loading	60.1°F.	60.0°F.
One day later	52.1°F.	43.9°F.
Two days later	45.9°F.	39.0°F.
Three days later	42.9°F.	38.1°F.
Four days later	41.2°F.	37.9°F.
Five days later	39.8°F.	37.0°F.

It will be seen from the table that this shipment was lower at the end of two days than is the average shipment, starting at the same temperature, after five days in transit. At the end of three days, the temperature of the shipment was as low as that of the average pre-cooled car.

The amount of salt that may be safely added to the ice in a standard car varies with the initial temperature of the shipment and the nature of the load. For oranges, six to ten per cent of the weight of the ice, or 600 to 1000 pounds may be used. Celery and lettuce, and quick cooling tender fruits will not stand more than 400 pounds. The salt should be added as soon as possible after the car is loaded. Most effective results will be obtained when the salt is placed on top of the ice which has previously been broken into fine pieces to prevent the salt from falling through crevices. Coarse salt, the ice cream size, or larger, should be used.

No discussion of the refrigeration of perishable shipments is complete without some mention of pre-cooling. The results of the refrigerator car investigations have served to strengthen the evidence already obtained regarding the value of pre-cooling and to show the necessity for cars of heavier insulation which will maintain the shipment at the low temperature secured in the pre-cooling room. It has been shown also that the efficiency of the pre-cooling obtained at a railroad plant after the car is loaded is insignifi-

cant compared with that which can be secured in a warehouse room, properly constructed and operated. Twenty-four hours, or less, in such a room is sufficient to cool a shipment to a lower temperature than is secured in the ordinary refrigerator car after a week in transit. The value of this prompt cooling in arresting ripening and decay has been demonstrated time and time again, both by experiment of the U. S. Department of Agriculture and on a commercial scale. During a normal season, the orange shippers probably need pre-cooling as little as the shippers of any product moving under refrigeration. It is a significant fact, however, that a large percentage of the fruit and vegetable pre-cooling plants in operation today are owned by orange shippers and associations. The fact that these plants have proven successful in the shipment of oranges make pre-cooling appear a necessity for the shipper of the more perishable vegetables and tender fruits who wishes to avoid undue loss.

The investigations of the Department have shown also that it is entirely practicable to forward pre-cooled shipments with initial icing only, even during summer weather. Initial icing will protect the shipment for at least a week, provided it is shipped in a reasonably well insulated refrigerator car.

The efforts made by fruit and vegetable growers to combat field diseases, to secure more careful handling, better grading and better packing have had their effect in more universal demand and higher prices for Florida products. Better refrigerator cars and pre-cooling for the products which require it, will place your industries on a still more stable basis and result in greater returns to you and every agency concerned in handling and transporting your crops.

Marketing Citrus Fruits

C. W. Barnes, Winter Haven, Fla.

The marketing of citrus fruits has not yet become an exact science nor has the marketing of any other farm product reached that stage. We are merely on the way. We have made some progress in spite of an extremely strong and selfish opposition.

This is certainly one of the foremost problems before the world today. And there is probably as much thought and work being put into it by men of real ability as in any other one problem. This is supremely desirable and I believe the problem will be worked out in due time.

I am not going to propose a solution nor what pretends to be one, but merely to outline to the grower a modest plan for picking and shipping his citrus fruit in a fairly scientific way.

I shall not touch upon the selling of the fruit in this paper, but confine myself to a discussion of the time of picking and shipping of the different varieties of citrus fruits as I see it through my experience as manager of a citrus packing house.

The first point, and it would seem that this point should not have to be mentioned, is that no fruit should be shipped until it is mature and fit for human consumption.

Here is where our common enemy—selfishness—makes his appearance and takes a most prominent part, but grows less as the season proceeds and finally fades away when there is no longer anything to be gained. I believe it is nothing less than absolute folly to ship any fruit until it is mature and will leave a good taste in the mouth. It may not be poison, as William Chase Temple's telegram of a few years ago intimated, but it certainly is not good to eat. A taste of good fruit creates an appetite for more of the same thing. A taste of sour, bitter fruit turns a good customer away and makes a "knocker" instead of a friend. It is simply good business to please a customer. Nothing else is good business.

Secondly, as to the quantity to be shipped. It is not possible and certainly very undesirable to ship all of any one variety in a comparatively short time. There are parts of the state where it gets pretty cold at times and it seems necessary to move the fruit early. And there are growers who are in need of some ready money, not having shipped any fruit since the past winter and with expenses going on all the time. But this should not mean that all of their fruit should go.

What I have to say is for the grower who has a grove for investment and expects to keep it and stay in the business.

For him I think a plan for handling his fruit is not only desirable but necessary for the proper and successful managing of his grove.

This means that there is a proper time to ship each variety, and in arranging a schedule, not only must the fruit be considered but the trees as well. No successful plan can be made without giving your trees just consideration and taking them into your scheme of things, for, after all, they are what make you the money.

Another point is that the plan should not be made and used just one year and then try to beat the game when conditions look favorable. There are too many growers who gamble on the market and I have known few who are successful at it. It is bad business. This plan should be for several years, preferably not less than three, and I believe the grower who does so will come out ahead, provided, of course, that he gives his grove the necessary fertilizer and work.

Different aged groves require different treatment.

We will take up the young grove first, that is, the grove of from 5 to 9 years. This aged grove is not likely to carry a large crop and it is not desirable that those just coming into bearing should do so, but whatever it has should be moved as early as possible, having in mind the quality of the fruit. Usually the quality is not the best. If it is good, then it should be shipped before the holidays. In any case the fruit should all be picked and on the way to market by the end of January. I would say, as a general rule to follow, that nothing but fruit of good quality and especially good color should go before Christmas.

With medium aged trees a slightly varied program will suffice.

A part of the fruit, if of sufficiently good quality, could be marketed before the holidays and the balance during January, with possibly some that is carrying well to hold over to early February.

On both the young grove and the medium aged grove the late oranges, or Valencias, should be sent to market as soon as the early oranges are out of the way.

Another general rule is that the longer you hold poor grade fruit the more money you will get for it, as all fruit deteriorates with age and little of it is fancy after it has hung on the trees all winter. The supply gets less and the demand usually rules good.

After the trees become what are called old trees, from 12 to 15 years and on up, then another plan can be used. The trees are now able to carry their fruit with less chance of exhausting their vitality.

The extra expense of picking over the trees is not very much and should not be considered as the returns will a great deal more than make it up.

The trees can be lightened up some and considerable fruit shipped before the holidays. Then in January all of the low-hanging fruit should be picked before it deteriorates too much and all trees picked clean where there is only a small crop on them as the few on the tree will continue to grow and become unmarketable.

I refer just now mostly to grapefruit. This leaves the heavily loaded trees in good condition to hold the balance of the crop and the trees that have been cleaned

in fine shape for the next crop. As I have said before, an eye must always be kept open for the new crop, as it is not one year that makes a success, but several.

On groves of considerable size and with old trees the fruit should be picked gradually throughout the season, an average portion in each month. But in any grove the trees with a light crop should be picked first.

There is one very important point about holding fruit for a late market. It may seem strange that I should call this a point, but it happens every season and must be noted. What I mean is this. No consideration of grove work, plowing, harrowing, pruning, etc., should be allowed to interfere with the marketing of your fruit. I have known many growers, who, after they have held their fruit through the winter and past the danger of a freeze, have come in and insisted on having their fruit picked at once as they were going to plow next week or spray or something else. This is a serious mistake as I have known growers to lose hundreds and in some cases thousands of dollars in this way. Very few growers give the marketing of their fruit enough thought, much less try to arrange a definite plan.

For the small grower who has only a few hundred boxes of each variety, there is one rule that fits very well, and that is, "ship all fruit when it is at its best." But this is not possible for the large groves and is not desirable. The market has to be fed evenly, not a feast one week and a famine the next. Anything that makes for better and more regular distribution is the thing to do.

In a large grove with old trees and a good crop I think it is best to put a few good pickers and let them stay there until the whole crop is moved. If this kind of a grove is in an exposed position I would begin on the west and north sides and pick towards the east and south, then the picked trees would shelter from the cold the unpicked trees.

A number of groves that ship through our packing house, whose owners live in the North and some who live on their groves, leave the shipping entirely up to me, trusting me to get the best returns possible and this is the plan that I try to carry out.

The Transportation of Citrus Fruits

B. E. Lennard, Atlantic Coast Line Railway, Jacksonville, Florida.

I have been in the transportation business in Florida for a good many years, and have seen the transformation of methods of packing citrus fruits from the old containers such as second-hand flour and sugar barrels, shoe boxes, and sacks to the very neat, and fairly substantial box that we have today.

I am very deeply impressed with the idea that if the price of Florida citrus fruits is to increase, and find its real place on the market, the grower must see that his fruit is so prepared as to insure its safe transportation to market.

Shortly after the beginning of the present fruit season we began to receive a number of reports from agents of the carriers at destination which showed that some cars were arriving with decay, with broken boxes, and in some cases the loads had shifted in transit. We decided that it would be a good thing to do to call on the shippers at all points from which shipments were being made on Atlantic Coast Line. Accordingly, this investigation was begun early in January, and practically all packing houses then operating were visited, and some of them two or three times.

The object of this investigation, or these visits, was not to criticise the methods employed in handling, and preparing the fruit for shipment, but more as an educational campaign, and an assurance of our co-operation. We invited criticism of the train, and other service incident to transportation, and wherever it was made we took the matter up with the proper authorities for improvement.

We believed then, and still believe, that it is the object of every shipper of every commodity to use the best means to the end that his products may reach the market in prime condition. Therefore, we did not hesitate to point out major irregularities, but this was not done until our mission was very clearly explained to the manager of the packing house. In almost every instance the manager thanked us for calling his attention to these irregularities, and the result has been a marked improvement. In full justice to the crate manufacturer and to the packers, I wish to say here that I was very greatly impressed with the unusual conditions under which they were obliged to work. Many crate manufacturers, and packers explained that they were forced to use inexperienced help, and that these conditions were largely the cause for their failure to prepare the fruit for shipment as well as they would have done under normal conditions.

In dealing with these questions, it is necessary that I do so in a general way; that is to say, that it will be impossible

for me to designate any special packing house or locality, or any crate manufacturer. There is another important point that I wish to impress upon you. That is this: The investigation was not made with a view of securing data that would enable us to combat just claims against the carriers. We believe that the moral law still predominates, and will always predominate. Therefore, we do not believe that a single claim will be filed against the carriers that is not just.

Unquestionably the fruit growers of Florida—in fact, shippers everywhere of every commodity—are beginning to realize that it is to their interest, to the interest of their customers, and to the interest of the consumer to employ the methods that will insure safe transportation, because good goods on the market means not only better prices, but stabilizes them, makes distribution easier, and above all, satisfies the consumer.

We think that we are one of the big factors in the Florida fruit industry; therefore, we want to co-operate with you in solving the problem of being able to place on every breakfast table in America a perfect specimen of the world's best citrus fruit. I repeat that it is not a question of claims, for it is true that there is not a railroad in America that has adopted, or ever will adopt, a policy of fighting just claims filed against it; that shippers everywhere are studying means to prevent claims is a fact, because claims do not pay dividends, but are an actual liability. The measures which are necessary to employ in claim prevention cost a great deal less than the cost of collecting claims.

We believe we can speak with authority, in reference to better packing, better containers, and better loading. We have sent representatives to all parts of the country studying the question. We wondered why the china and wine merchants of Europe and the Orient could send their wares to all parts of the world under almost every conceivable method of transportation without damage. The secret lay in the fact they used only good containers, and packed their goods securely. Go to the docks of any of the big ocean liners, and you will find that I am correct.

You ask the question—can these results be accomplished with citrus fruits? My answer is yes. It is being done by a number of growers in Florida today, and I feel absolutely certain that they have not failed to receive maximum prices for their fruit. And in addition to this, these growers enjoy the entire confidence of their customers, and they have also increased the demand for their fruit.

The Atlantic Coast Line believes in Florida. It extends to the growers, and to all other shippers, the best service that modern transportation knows, commensurate with the business offered. If it can offer you any suggestion as to marking, and packing, and loading, it stands ready to help you without cost. As I said in the beginning, I must deal with this question in a general way. But I feel quite certain that you wish to know the result of my investigation as to packing and loading citrus fruits, because as a grower it means a great deal to you for, undoubtedly, you are bound to profit by having good fruit on the market.

A careful investigation developed many

material defects in crate material, both as regards manufacture and quality of the wood. A most thorough inspection was made, usually in the presence of the manager of the packing house, and the defects were very carefully noted. Where possible, I called on the crate manufacturer in the interest of better containers, and I have recently noted some improvement. But in justice to the crate people, I must say that they are not entirely responsible for weak or insecure containers. I found some box-making machines out of order, hand box makers careless or indifferent, using imperfect frames or frames that were not true, center heads not placed exactly in center of crate thus making one compartment larger than the other, insufficient nails, etc.

We believe that in loading citrus fruits in cars every precaution should be taken to insure safe transportation. There are certain rules that must be followed, or the wear and tear incident to transportation will cause the load to shift in transit, and break some of the boxes. These rules have not been observed by all shippers in all instances during the present season, although I am very glad to say that there has been a marked improvement in nearly all cases.

There are certain standards or practices that are necessary in the picking, hauling, packing, and loading of citrus fruits that are well known, and I shall not undertake to repeat or enlarge upon them here. But I am frank to say that there are some shippers that are not observing all of these methods in the preparation of their fruit for market, and this is undoubtedly the cause for some of it reaching the market in a decayed condition. Failure to load the cars properly has been a contributing factor or is the reason why some cars have reached destination in a damaged condition. To my mind, the utmost care should be used in all these matters, because the slightest decay, or the slightest damage from broken boxes, or a shifting load, can lead to but one result, and that is a reduction in the price of the fruit.

It is thought that the next citrus crop will be the largest in the history of Florida. May I not therefore suggest to the growers, packers, and shippers that they make ample preparation for the proper handling of this crop. Give thoughtful consideration to every phase of the question that has to do with the entire preparation of the fruit for market, and you will find ready buyers, for I believe that I can safely say that if the fruit is well packed, and loaded, we will come pretty near delivering at destination in the same condition it is received.

The Manufacture of Crates in Florida

M. Overstreet, Orlando, Florida.

The manufacture of crate material in Florida dates back to about 1889. Prior to that time the sides for orange boxes were shipped here from Maine and were known as the Bangor box. In the year 1889-90 there were two lathes put into operation; one by McEacham, located at or near Longwood, the other by what is now Warnell Lumber and Veneer Company, located at Warnell. They all used solid heads. Mr. A. D. Starbird was the first man to introduce the doweled head. The panel head was introduced by George W. Moyer, located at Altamonte, Orange county, Florida.

Vegetable crates did not become a potent factor in the industry until after the freeze of 1894-05. There were shipped from the State in the season of 1886-87, 1,260,000 boxes of oranges. The number gradually increased until the season of 1893-94, when there were shipped 5,055,000 boxes; in the season of 1894-95, 2,808,000 boxes; in the season of 1895-96 147,000 boxes. From that time the number gradually increased until the season of 1914-15, when the maximum number shipped from the State in one season was reached, 9,700,000 boxes. During the following season, 1915-16, there were shipped 8,370,000; in 1916-17, 7,649,000; in 1917-18, 5,581,000; in 1918-19 approximately 8,000,000.

While it is early in the season to accurately estimate the crop for 1919-20, it is generally conceded that it will probably reach 10,000,000 to 12,000,000 boxes.

There were shipped from the State in the season of 1917-18—celery, 1,101,000 crates; lettuce, 1,056,000 crates; tomatoes, 1,490,000 crates; potatoes, 954,000 barrels; cabbage, approximately 220,000 crates; cantaloupes, 250,000; pineapples, 14,000, making a total of all packages for the season of 1917-18, 10,666,000.

The figures for the 1918-19 crop cannot be given for the reason that the season is not yet over.

DISTRIBUTION OF CRATE MATERIAL.

The present method of distribution of crate material by the manufacturers is very crude. It does not deal fairly with themselves, to say nothing of the inconvenience it brings to the packer or grower. There is no good reason why there should be a shortage in crate material for any commodity at any time. The mills have the capacity for taking care of all the crops, if their capacity were properly utilized. Under the present method the packer, or grower, places the order for his crate material with the manufacturer; the manufacturer accepts the order

in good faith. But, during the season he encounters what we might call unforeseen trouble—such as fire, excessive rain, labor troubles, failure to get wire, nails, twine, etc.—so that he fails to fill the order of his customer and thereby necessarily brings about considerable inconvenience and perhaps a loss to him. Again, if for some good reason the purchaser of crate material fails to take the quantity of crates ordered from the manufacturer, there should be some method of disposing of this material to someone who, perhaps, is in particular need of the same.

I can not too strongly urge the formation of a central selling agency, that will take over the selling and distributing of all crate materials manufactured by all the mills. If this should be done and a proper tabulation of all crops grown in the State compiled, the selling agency would know how many of each package would be needed, and when and where they would be needed. They would naturally have the mills manufacture such goods as would meet the demands for taking care of the crop to be moved, at the time they would be needed during the season. This plan would give 25% higher efficiency in manufacturing; that is, they could manufacture 25% more goods than they can under the present plan. The manufacturers could manufacture the goods cheaper, and there would be a saving brought about by shorter freight hauls. This plan could be worked out and it should have the co-operation of the users of crate material.

PRICES OF CRATE MATERIAL AS COMPARED WITH OTHER COMMODITIES.

The prices at which fruit and vegetable packages are selling today are not out of line with prices received for other commodities. Crate materials of all kinds have advanced about 100% in the two or three years past. The prices received for nearly all other commodities have advanced in the same proportion. The advances were absolutely necessary on all lines, for what affects one affects the others. It is hardly necessary to mention, or to try to enumerate the causes of these advances, for they are well known to all business men. But, in order to clear the minds of those who think there is an abnormal profit in manufacturing these goods, I shall enumerate a few of the most essential things that enter into the cost of manufacturing the various packages.

First: The labor conditions.

It is a well known fact that labor is 100% higher than in normal times. It is further a well known fact that the labor employed by the manufacturer is from 33 1-3% to 40% higher in deficiency. The manufacturer has been compelled to use a class of laborers that he would not have thought of using three or four years ago. He has been compelled to use old men, women and boys who were not accustomed to this kind of labor. The component parts that go into a package are very small pieces and have to be handled many times before they are ready to be assembled. The slow movement of the laborer in handling these parts naturally

increases the cost of production. The skilled men for operating the various machines were necessarily men between the ages of 18 and 35 years, for it takes a quick movement and a person who can use both hands and a foot at about the same time. These men were all in the draft age. Many of them enlisted, while a small per cent of them waited to be drafted. Their places had to be filled by men who knew nothing about the machines, and, in nearly all cases, by men who could not create a movement sufficiently quick to get the maximum capacity from the machine. Therefore, there was a loss of production on account of his inefficiency. Not only a loss of efficiency, but also a loss of wasted material.

There has been some complaint among the packers about the poor quality of material furnished them by the manufacturers. In the past two years, this was brought about by the unskilled labor. The manufacturer fully recognizes the poor quality of the package and regrets it more than the person who has to use it.

Second: Raw material has advanced 100%. Logs that in former times cost from $2.00 to $3.00 per thousand stumpage, now cost from $5.00 to $6.00 per thousand. Nails, wire and twine have advanced over 200%. It is a well known fact that the manufacturer of these packages for many years received almost no profit at all, and, in many cases, had heavy losses. This was brought about by ignorant competition, by men who had no cost system, but simply relied on the thought that they could manufacture and sell for less than their competitors. The competitors had no cost system themselves and were laboring under the same opinion that their neighbors had of them. If they had not finally resorted to purely business methods there would have been but few mills in the territory today—not enough to have handled the crops.

PRESENT CAPACITY OF MILLS IN THE SOUTHEAST, AND PROSPECTS OF SUPPLYING NECESSARY CRATES IN FUTURE.

The capacity of the mills in the southeastern territory is, at the present time, around fifteen million packages. During the past season eleven million packages were shipped from Florida. If the orders were placed early in the summer the mills would have no trouble in manufacturing all the packages necessary to move the crop. But, in order to finance their mills and get the maximum capacity, they must have the co-operation of the users of their materials. It is no easy matter for some of the mills to finance themselves through the summer and early fall. Their method of selling their goods is such that the banks will not, nor can they, loan them the money necessary to carry them through this period. If, as I have stated above, they had a selling agency, they could be financed, for the selling agency would systematize the operation of the mills in such a way as would give protection to the banks and they could get all the money needed. The capacity of the mills and the prospect of the mills finishing boxes in the future depends altogether upon the co-operation of all concerned.

Food Products Inspection Service of the United States Bureau of Markets

H. E. Kramer, U. S. Department of Agriculture, Washington, D. C.

I was very much gratified when I was asked to come down here to explain the nature and purpose of the Food Products Inspection Service of the Bureau of Markets, both because I have never before been privileged to visit the Southern States, and because this seemed an excellent opportunity to bring the inspection service to the attention of a great many people who are not yet familiar with it, and who are in a position to benefit by its use. We desire especially to make this service known in those states in which there are large fruit and trucking interests, and from which come a large part of the supplies of fruits and vegetables for the large Northern and Eastern markets.

This service was inaugurated in November of 1917, under authority of the Food Production Act of August 10 of that year, and was designed particularly as a war emergency measure to assist in the movement and the conservation of food. Prior to this time, however, there had been a demand for the establishment of such a service, and now that the war is over the work is being carried on as a purely peace-time measure and it will in all probability be continued as a part of the permanent organization of the Bureau of Markets.

The objects of the Food Products Inspection Service are to facilitate the distribution and marketing of farm and orchard products, to hasten the releasing of the cars used in transporting these products, and to prevent deterioration and waste. These ends are accomplished chiefly by furnishing the shippers and handlers of fresh fruits and vegetables detailed and unbiased reports of shipments, particularly on those over which disputes arise. These certificates afford a basis for the settlement of differences between shippers and receivers or claims against the railroads.

In our work we make inspections of all fresh fruits and vegetables. The inspection of butter also is being started in five of the largest northern markets, and other farm products may be included from time to time. At the present time inspection offices are maintained in 28 of the more important markets throughout the country, chiefly in the middle and western states. Six or eight inspectors are kept busy in Chicago and the same number in New York. In a few other cities two men are stationed and in the others one inspector is able to handle the work. In addition to the cities in which offices are maintained about 140 additional markets

have been designated by the Secretary as points in which inspections may be obtained. These cities are served by the inspector in the nearest established office.

We do not attempt to make inspections of all shipments of fruits and vegetables arriving in a given market, but simply hold ourselves in readiness to inspect a given carlot or other shipment when formally requested to do so by one of the interested parties. When such a request is made, the inspector makes a careful and thorough examination of the car and reports the facts as he finds them, on a formal certificate. The original of this certificate is delivered to the applicant and a copy to the shipper if other than the applicant. It may be well to remember this last point in case a receiver tries to bluff, as has been done once or twice, by declaring that the car is in bad condition and that his statement is supported by Government inspection. If you are the shipper you will know, if you have not received a copy of the inspection certificate, that no inspection has been made by us.

In order that this service may be partially self-sustaining a small fee is charged for the inspection. This fee is $2.50 for a shipment of half a carload or more up to a full carload, and $1.50 for a shipment of less than half a carload. It is intended that, in time, the fees will make the service nearly, if not wholly, self-supporting, although that is not the case at the present time.

This service has proved in practice to have both a direct and an indirect value. There have been in times past a great many rejections of shipments by unscrupulous dealers, particularly when market conditions prove to be unfavorable at the time of the arrival of the car. On the other hand, a great many shipments of highly perishable products arrive upon the markets in very poor condition, some of them being practically worthless, on account of decay and other causes. The inspection service is designed to furnish a prompt and full report of the exact condition of the shipment in order to expedite the handling of it, to release the car promptly for further use, and to furnish a basis on which shipper and receiver can make adjustments. Obviously, an accurate and unbiased report of this character is of great advantage to the shipper, particularly when he is one or two thousand miles away; and in case he has reason to suspect that the shipment arrived in better condition than reported by the receiver he can easily obtain definite information from an impartial judge through this service, by wiring or writing to the inspector in that market asking that an inspection be made.

This work is of value to the shipper also in calling attention in many cases to improper methods of loading or to poor grading of the product. It happens also that many shippers who are operating at a number of different loading stations in the producing section are compelled to send out shipments which they have no opportunity to inspect personally and must depend upon the grower or loader for information regarding the grade and condition of that car. During my experience in the Cincinnati market last summer I had occasion to write to one shipper of southern potatoes calling his at-

tention to the poor condition in which they reached the market and the poor loading, and as a result he investigated and found that shipments were going out under much different conditions than he thought prevailed.

As you all know, there used to be many rejections on a falling market. There were unfortunately some operators who made a practice of ordering cars right and left, depending on a rise in prices before the arrival of the cars to return them a profit. If, on the other hand, the market went the other way, it was an easy matter to find some fault with the car, perhaps wholly technical, and so reject it. Such men are finding it much harder now to get by with anything of that sort, at least for any length of time, and find it practically impossible to reject cars unless there is a real reason for such action.

The shipper is not the only one to benefit by this inspection service, however. The receivers were very quick to realize its benefits and to demand that the privilege of making applications for inspection be extended to them. They, as a class, were very ready to welcome any organization which would protect them from the unfair competition of dishonest dealers, with its accompanying slashing of prices and demoralizing of the market. They naturally are not disposed to accept losses for which some one else is responsible, as is very frequently the case. You who have had no experience at the receiving end can have no adequate conception of the tremendous amount of worthless or injured fruits and vegetables constantly arriving in the markets. In very many cases, then, the receiver is absolutely correct in reporting a very heavy percentage of decay. Unless he is well-known to the shipper, however, there is always the chance that the latter may be just a little skeptical about the truth of such statements. If these statements are true, our inspection reports corroborate the word of the receiver and protect his reputation against unjustified criticism. Shipper and receiver can consequently get together in making proper adjustments and can devote their efforts to devising means to prevent a recurrence of such losses, instead of spending it in mutual recriminations.

These are advantages resulting from the use of the inspection service on particular cars. In addition to all this, there is an indirect but very substantial effect of this service on the trade generally, and is felt at the shipping end as well as in the markets. The fact that such an inspection service is available, reduces the temptation to reject shipments on trivial or fictitious grounds and so places the whole produce business on a more stable basis. Again, this service brings about more careful trading between shippers and dealers. Terms and conditions of sale are stated with greater clarity and precision and are in more and more cases being put down in writing. Thus the buyer and seller are more nearly in agreement on their contracts and the chance for misunderstanding or misinterpretations are reduced. The growers too are shown the results of packing and shipping undergrade or infected stock and realizing that their products are subject to inspection in the markets, they are led to practice greater care in spraying and other meas-

ures designed to hold these troubles in check.

Incidentally other valuable results have followed. The certificates often call the attention of shippers to needed improvements in methods of packing, field handling and disease control. The service is also of marked value as a source of information concerning the character and cause of deterioration of the commodities reaching the markets, and this information is used to good advantage by other branches of the Department of Agriculture, particularly the Bureau of Plant Industry.

I want to emphasize the fact that this work is purely a service and is in no sense used as a regulatory or police power. During the war, the enforcement division of the Food Administration exercised authority of this kind, as you know, and did very effective work in settling disputes and preventing interruptions in the flow of food products to the markets. That particular function of the Food Administration was abrogated on the 10th of last December, and there is now no Federal organization which acts in that capacity. All we do is to report the facts as we find them, covering so far as possible all the points regarding a shipment which would have a bearing on its commercial value or on the fixing of the blame if that value has been impaired. It is our aim at all times to stick very closely to facts and to avoid all statements which are purely expressions of opinion. If we find decay present, for example, we state the extent of it and also the particular type of decay, whenever the inspector is able to identify it beyond a reasonable doubt. The type of decay is, we feel, a question of fact, and so should be reported. On the other hand, we make no attempt to fix the responsibility for such a condition or to express on the certificate any opinion on this point.

The inspector's work ends with the issuance of his certificate. He has no authority to act as arbitrator or to help settle any dispute which may have arisen over the shipment nor can he offer advice as to the reduction to be made in the price of the shipment. It is our purpose at all times, however, to make the certificate so thorough and comprehensive that it will serve as a very clear basis on which buyer and seller can settle their troubles.

In order to make our reports of real value in this way, we strive at all times to make them conform to trade customs. We have from the beginning tried to avoid any appearance of imposing grade and other regulations upon shippers and dealers by ex cathedra pronouncements from Washington. We have realized that this service would be of real value only if it was based on the best trade practices and recognized commonly-accepted customs and conditions. We are constantly striving to steer away from mere technicalities and to avoid mention of any faults in a shipment which might have an academic interest for laboratory workers but which have no importance whatever in trade channels. In reporting decay or other blemishes we always prefer to use the commonly-accepted trade names rather than scientific names, provided the trade names are commonly known all

over the country, and to phrase our reports in a way to make them intelligible to anyone who has occasion to read them.

A word in regard to the qualifications and ability of the men employed in this service. In selecting them, very careful attention has been paid to their adaptability to this particular work and as a whole they combine good education, practical experience and plain common sense in an unusual degree. None is selected to take charge of a market unless he has had at least several years' experience in some phase of the fruit and vegetable business. Two or three young men have been appointed who were recently graduates of agricultural colleges but these have been placed as assistants to older and more experienced men. This previous experience is supplemented after appointment by a short but intensive course of training under one of the supervising inspectors either in Chicago or New York, where they are carefully coached in our methods of work and where they become familiar with such fruits and vegetables as they have not had to deal with before. Their training does not cease with this, however. In fact, it continues as long as they remain in the service. Their work is under close supervision at all times, both by the Washington office and by the supervising inspector. Their certificates are reviewed by the supervising inspector, and by Mr. More and myself in Washington, and any statements which seem to be in any way questionable or any points in which they deviate from the standards fixed, are called to their attention. This does not mean that we ask all of the inspectors to phrase their certificates in exactly the same way; that of course would be impossible in any case, since every car is a little different from every other car. We do, however, make a special point of securing uniformity of methods in order that the inspectors may all cover the same points and omit those things which should be omitted and that they may interpret the specifications of grade, in case they enter in, with the same degree of rigor. Uniformity and improvement of the work is sought also through occasional conferences of the inspectors at the various supervising inspectors' offices. There the men become acquainted with each other, exchange views and experiences and are given definite instructions on particular points that have arisen in the course of the inspection work.

In the selection of these men, more attention is given to practical commercial experience than to technical training in plant pathology. They are, however, given the benefit of such teaching during the course of their work by plant disease specialists from the Bureau of Plant Industry. Five or six such specialists have been detailed by the Bureau of Plant Industry to the New York and Chicago offices, where they maintain laboratories and carry on studies in plant diseases, especially those affecting stock which appears in the markets. They are in close touch at all times with the various inspectors, not only those located in those particular cities, but throughout the country, and make it a point to instruct the men in the more practical phases of plant pathology. They give us valuable assist-

ance also in connection with specific inspections by identifying diseases about which the inspector has some doubt. In such a case, the inspector sends in a sample of the stock in question and this is carefully examined by the plant pathologist and a report on the nature of the trouble sent back to the inspector.

In addition to this, two men from another branch of the Bureau have for the last two years been carrying on extensive studies in connection with the Chicago office to obtain some exact and reliable data in regard to temperatures at which various products suffer deterioration. Every winter there is a great deal of loss through freezing or chilling of products in transit and in a severe winter like that of a year ago, these losses are enormous. It is hoped that the studies being carried on will lead to the adoption of means to reduce such losses.

As an indication of the care given to the selection and training of the inspectors, I may say that in the first months of this year nine men from other branches of the Bureau of Markets were assembled in Chicago for training for this work. At the end of the training period, only three of these nine were certified as being suitable to become food products inspectors.

In making our inspections, we aim always to be very thorough and to inspect packages from all parts of the load. One of the first pieces of equipment with which the inspector supplies himself is a pair of overalls. He cannot feel sure that he has covered the car thoroughly unless he sees packages from the top and bottom of the load and from the ends, as well as the middle. It often happens that the car is so heavily loaded that such an inspection is not possible and that only the packages in the and near the center of the car are accessible. If that is the case, the certificate is restricted to that portion of the load and a notation to that effect made upon it.

There are other limitations to our work as well. The law gives us authority to inspect these products only when received at such markets as the secretary has designated. During the period of the war we were working in close co-operation with the Food Administration and largely for the purpose of assisting them in their work of settling disputes; we made occasional inspections of cars located in markets which were not officially designated. At the present time, however, we confine our work entirely to the designated markets.

This brings up the question of shipping point inspection. We are constantly receiving requests from widely separated points throughout the country, and from different interests, to establish a shipping point inspection service to examine cars as they go out and certify as to the grade, if they are sold by grade. The wording of the law which I have just quoted provides no authority for the establishment of any such service. Two different measures were introduced in the last Congress to provide such authority. One was an amendment to the Agricultural Appropriation Bill proposed by Senator Jones of Washington; the other was the so-called Lever Bill. No action was taken upon

either. It may be that these or similar measures will be re-introduced in the coming Congress and it is quite possible that authority will be provided before long to carry on shipping point inspection. If that is done, there are a number of difficult points in connection with it which would have to be worked out to make the service a success. It would necessitate finding a large number of men of sufficient ability and responsibility to perform the work effectively. It would mean also a considerable appropriation to carry on the work until it became thoroughly established and in a measure self-supporting. It probably would not be possible to cover at the beginning all the districts and all the products for which shipping-point inspection was requested, and it might prove rather hard to determine just which ones to choose without appearing to be partial.

It is a question also whether those shippers who ask for such an inspection service would not expect too great benefits from it. The impression exists apparently in some quarters that in the case of sales made f. o. b. shipping point, such inspection would give the shipper or grower a clean bill of health and release him absolutely from all responsibility no matter what the circumstances. It is a question just how this would work out in practice. Undoubtedly we would still be called in to make inspections of some such cars arriving in the markets which had suffered deterioration in transit. It would easily be possible for stock with a heavy infection of some decay organism to appear perfectly sound at the time and place of shipping, and the shipping-point inspector would naturally pronounce it good. With decay inevitably resulting before arrival in the distant market, the buyer would naturally protest and if it could be established that the facts were as given in this instance and the trouble were due to field conditions, the carrier would not be disposed to shoulder the blame.

It might be well to consider also the effect which such an inspection service would have on the disposition of receivers to make f. o. b. purchases. Assuming that the inspectors were thoroughly competent, would the dealers be willing to make f. o. b. purchases more freely than they do, depending on this inspection to keep the stock up to specifications, or on the other hand would the natural inclination of the shipper to stand on the inspection certificate against claims for later deterioration tend to discourage the receiver from making f. o. b. purchases and to make him insist upon buying stock delivered subject to inspection in the market? These are all points to be considered in any discussions you may have on the advisability of establishing such a service.

I would like to say in closing that we at all times welcome suggestions and criticism. We are all only human and do not pretend to be infallible. To make our certificates of any value at all, we must make them comprehensive and state all the facts as we find them. Naturally, even with the greatest possible care we run some risk of occasionally making a slight error. I may say, however, that

since the beginning of this service, or at least since the first few weeks in which men were being trained and methods and practices crystalized, no inspector has involved himself in any very serious or vital error; and we have made altogether some 17,000 inspections. We might, of course, carry caution to an extreme and exclude from the certificates every statement which might conceivably prove erroneous, but if we did that, the certificates would be as colorless as a drink of water and of as little value as a German treaty. But to make our work as nearly perfect as is possible we are constantly studying the demands and suggestions of the shippers and dealers and as a result we change our own ways occasionally in minor matters to conform to them.

Avocados, Particularly Guatemalans

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Three years ago, when I left the United States to carry on agricultural explorations in Guatemala and Mexico, the term "Guatemalan avocado" was rarely heard in Florida. Upon picking up the proceedings of this Society for 1918, I find it filled with references to this valuable race of that most valuable of all fruits. What are the reasons for this sudden increase of interest in the Guatemalan avocados? I believe they are two: in the first place, the cold winters experienced in Florida recently have awakened avocado growers to a fuller realization of the desirability of planting the hardiest varieties obtainable; and, in the second place, the Guatemalan avocados promise to furnish an abundance of fruit during the winter and early spring, at which season high prices are obtained.

We have had plenty of avocados in Florida during late summer and early fall, and a few in late fall and winter; but until the Guatemalans were introduced it has not been possible to have them abundantly during the winter months. These two points, hardiness and winter bearing, are the characteristics of the Guatemalan race which should have unlimited emphasis. There are several other characteristics which merit our attention, notably the thick, hard skin of some varieties, and the vigorous growth of others.

Three years ago several pioneer avocado growers on the lower East coast recognized the possibilities of the Guatemalan race and began to plant a few trees experimentally. At that time we did not know how this race was going to behave in Florida, except in so far as we could judge from the performance of a few seedling trees in the Plant Introduction Garden at Miami. Today, however, we have enough experience back of us to warrant the belief that it is destined to play a very important part in the future of the avocado industry. While in South Florida recently, I asked several of the most prominent avocado growers what they thought of the Guatemalan race. All of them, without the slightest hesitation, replied that it was the coming race for commercial cultivation. It only remains for us to thresh out the question of varieties. We know less about this subject than about any other phase of avocado growing, and it will take several years to determine which varieties are the ones to plant in different sections of the State.

Realizing the importance of obtaining for North American horticulturists the best avocados the world affords, the De-

partment of Agriculture several years ago undertook a series of explorations of the principal avocado regions of tropical America, a series which we hope to continue until all of the promising territory has been covered. Then we can proceed with the development of the avocado industry in this country feeling that we have built its foundations upon the best available material. This work is particularly urgent just at this time, when the industry is still in its infancy. If the avocado groves of this country are planted to inferior varieties, they must ultimately be worked over to better ones, entailing enormous losses of time and money. If, on the other hand, we can secure really excellent varieties before the industry has attained large proportions, most of the groves will be planted with satisfactory varieties in the beginning.

One result of my sojourn in Central America has been that I have come to realize more than ever before the intrinsic value of the avocado as a food, and the enormously important part it is capable of playing in the dietary of a people. Ever since the early days of the avocado industry in the United States, we have harped upon the food value of this fruit, pointing out its similarity to eggs, milk, beans, beefsteak, or any other staple article of diet for which we chanced to possess a predilection; but it took a trip to Guatemala to impress me, not with the food value of this fruit as expressed in calories, but with the extent to which it can replace meat in the every-day life of a people. I wish you could have been with me on some of my trips across the Guatemalan mountains, to see the Indian *cargadores*, men who carry immense burdens upon their backs across a hundred miles of broken country, sitting beside the trail at noonday, eating their frugal meal of tortillas (corn cakes) and avocados. I asked my own Indian servant, a boy from the mountains of northern Gautemala, "What do you consider a good meal?" "Four or five tortillas, an avocado, and if I can afford it, a cup of coffee," was the reply. The amount of work which the Indians are capable of performing upon such a diet as this is perfectly amazing. I have often wondered how one would be affected by living exclusively upon avocados for a time. I do not believe the avocado contains enough roughage to satisfy the appetite of a man doing outdoor work, no matter how much nourishment it might give him.

The Department of Agriculture has just published bulletin No. 743, "The Avocado in Guatemala," which contains in full the observations which I made during my sixteen months' stay in Guatemala. In this paper I will limit myself, therefore, to a brief consideration of certain points which I feel should be of particular interest to the many horticulturists in South Florida who are embarking upon the cultivation of this promising fruit.

While traveling through Florida last month, I was several times asked, "Why are the Guatemalan avocados hardy? They come from way down in the tropics, where it ought to be much warmer than it is here." To answer this it is only necessary to explain that Guatemala is a mountainous country, many of its towns

and villages lying at elevations of 5,000 to 8,000 feet. With every thousand feet of altitude there is a certain difference in the temperature, some of the higher levels being subjected to lower temperatures than are usually experienced in South Florida. Citrus fruits are not grown in Guatemala at elevations greater than 7,500 feet, because of the danger from frost, but I have seen occasional avocado trees at elevations of 8,500 feet. This does not prove that any of the Guatemalan avocados are hardier than the orange; I suspect that other factors than frost resistance entered into the matter. But it does give us much encouragement, and, I think, grounds for the belief that it will be possible and practicable to cultivate avocados commercially throughout the same region as oranges and grapefruit.

In regard to cultural methods, it is not safe to be guided by the observed practices of the Guatemalans. Everyone who knows the tropics realizes that horticulture in that part of the world is, generally speaking, altogether primitive in character, and that groves of fruit trees, planted in straight rows and well cared for, are almost unknown. In Guatemala the avocado is essentially a dooryard tree. It springs up about the houses of the Indians from seeds cast aside after the fruits have been eaten, and it is found here and there in coffee plantations, where it serves as one of the several species of large trees which furnish shade for the coffee bushes. It is never propagated by budding or grafting, and no pruning or manuring is done, with very rare exceptions. Insect pests are allowed to work unhindered, and no water reaches the tree except that supplied by nature. It is not safe to argue that because the avocado exists under such conditions, they are best for it. Observing the behavior of the trees in different regions, I came to believe that they did best when on moist and reasonably heavy soils in which there was an abundance of humus. For this reason I feel that it will be important, here in Florida, to increase the humus content of the soil by every possible means (except in those instances where it is already great), and to insure an abundant water supply at all times of the year. True, the avocado succeeds in parts of Guatemala where there is a dry season of about six months' duration, but it also succeeds in other parts of the same country where the rainfall is 140 inches per annum, distributed throughout the twelve months. A moist subsoil seems to be essential if the region has no rainfall during part of the year.

Years ago it was recognized that there are several distinct races or species of avocados. Some of these races are hardier than others, and some varieties of each race are hardier than other varieties of the same race. The large, thick skinned fruits of the West Indies and the small, thin skinned ones of Mexico have long impressed all who studied them as distinct in some manner. The researches of recent years have carried us far toward the solution of this problem, and it is reasonable to hope that another two or three years will give us a satisfactory understanding of the whole matter. Horticul-

turists are now classifying the avocados cultivated in the United States into three groups, to which a fourth will have to be added. These three groups are the West Indian, Guatemalan, and Mexican races, so-called. The fourth group which must be added is a category to include crosses or hybrids, of which we already have one, the Fuerte.

The three groups which we term races, when studied minutely, seem to form in reality two botanical species. One of these includes avocados of the Mexican race. This is such a distinct group that we believe it will be necessary to restore it to the standing of a botanical species. It was described as such (under the name of *Persea drimyfolia*) in 1831, but recent botanists have reduced it to a variety of *Persea americana*. The Guatemalan and West Indian races possess sufficient similarity in botanical characters so that we must consider them nothing more than two expressions of the same species; in all probability the West Indian race is the lowland or tropical form of *Persea americana*, and the Guatemalan race is the same species as it has developed in the cool highlands of the tropics.

To the horticulturist, all this may seem irrelevant, and of no practical application; but we must understand our avocados thoroughly before we will know exactly how to work with them in the orchard, and first of all, we must know with what we are dealing. I believe it is safe to say that no other feature has played a more important part in the development of the avocado industry than our knowledge of races (or species, if they are such); if we had not realized that there were distinct races of avocados, differing in their climatic requirements, we might still be attempting vainly to grow Cuban avocados in California, and Florida would never have paid any attention to the hardy, winter bearing Guatemalan race. It is essential to the success of the industry that every horticulturist who is cultivating avocados should acquire a thorough understanding of the characteristics of the cultivated races. This is not altogether easy. He can depend upon his nose to tell him when a variety belongs to the Mexican race (unless he happens to strike a hybrid like Fuerte, and they are exceedingly rare), but the differences between the West Indian and the Guatemalan are more subtle. The anise-like odor given off by the crushed leaves of the Mexican race is an infallible guide. The hybrid Fuerte, however, also has this characteristic, and would have to be classed as a Mexican did we not have sufficient grounds for believing it to be a hybrid between the Mexican and the Guatemalan. Neither the Guatemalan nor the West Indian ever have the faintest trace of anise odor in their foliage. The differences between these two races are rather vague, but in general it may be said that the Guatemalan has a fruit with harder skin (often thicker as well) than that of the West Indian, with the seed always tight in its cavity (as opposed to the oftentimes loose seed of the West Indian), and that as a rule the Guatemalan varieties are considerably hardier than the West Indian. I believe there are avocados which are intermediate between

these two groups, and which it may be impossible to classify with accuracy as belonging either to one or the other. As previously stated, the West Indian is probably the lowland expression and the Guatemalan the highland expression of one and the same species. At intermediate elevations may have originated intermediate forms, which have neither the distinguishing characteristics of the West Indian group nor those of the Guatemalan. We will perhaps have to take the extreme form of each group as our standard, and classify many varieties as intermediates. The Guatemalan group should be kept for hardy, winter bearing varieties, and the West Indian for tender varieties which ripen in summer or fall.

Now as to the behavior of these three races in Florida, and the possibilities of each as we see them today. I have recently traveled through the southern and central portions of the State, and have been tremendously interested in the results which are being obtained there.

We cannot rightly enter into this subject without first touching upon the question of stocks. I use the word "touch" advisedly, for I do not believe we can do much more than that until we have more experience than at present.

No experienced horticulturist purchases an orange tree without first knownig whether it is budded upon rough lemon, sour orange, or other roots. He sizes up the conditions, decides upon the stock which will probably do best, and then orders trees which have been budded on that stock. The application of this principle of stocks to avocado growing is one of the most interesting developments of the last few years. It is true, of course, that the Californians have been using Mexican seedlings for some years, with the idea that they would produce hardier plants; but the comparative testing of different stocks under the same environmental conditions is as yet a very new subject, and one on which we have relatively little knowledge. In California, West Indian seedlings have been found altogether too tender to serve as stock plants, and the use of Mexicans, as opposed to Guatemalans, has come about largely through the lower price and greater abundance of Mexican seed. In Florida everything has until very recent years been grown upon West Indian stocks. We now begin to see tests of the other races, with some interesting results already evident. It is becoming clear that the individual varieties of each race differ greatly in habit of growth and consequently in their suitability for use as stocks. I believe it is safe to say that next to the question of varieties, the question of stocks is the most important one to be solved within the next few years. I should not be surprised to see certain varieties selected as the best for stock plants, and thousands of seedlings of these varieties grown for this purpose. At present no one thinks of inquiring into the matter any further than to determine the *race*, and few people, unfortunately, go even this far.

In the Miami region Guatemalan avocados have been tested more thoroughly than in any other part of Florida. I presume as many as fifty varieties have been

planted there experimentally, but not all of them have yet come into fruit. From these experiments we learn that individual varieties differ enormously in their reaction to the soil and climate of the region, and in learning this we hit upon a point which it would be well for every prospective avocado planter to keep firmly in mind. I would like, in fact, to put this statement in sixteen-point, black face capitals, or something similarly conspicuous: *No Guatemalan variety should be planted extensively in any given locality until it has been tested in that particular locality*. Perhaps we may some day have sufficient experience with certain varieties so that we can waive this rule, and plant them with confidence throughout the southern end of the State, even in sections where they have not previously been tried; but when we see the Taft doing famously at Homestead, and a complete failure (so far) at Miami, it makes us realize that a commercial planting of Tafts in any region where the variety had not yet been tested would be a precarious undertaking. The Guatemalans, in some instances at least, are delicate creatures, succeeding in certain places and utterly refusing to succeed in others. Further than this, we have discovered that several varieties which have been propagated on a very limited scale have the unfortunate habit of pining away about the end of their first year in the orchard (or perhaps earlier), and after lingering for a few weeks in a moribund state, giving up the ghost. This same peculiarity was noted in California a few years ago, and because of it a number of otherwise promising varieties had to be discarded. I repeat, therefore, that it is necessary to proceed with caution. The proper procedure, for those who wish to embark upon avocado culture in sections of Florida where the Guatemalan varieties have not been thoroughly tested, is precisely that which is being followed by Mr. Krome at Homestead, Mr. Johnson on Pine Island, Mr. Niles and Mr. Carrier at Winter Haven, and several others in other sections, namely, to plant a small experimental orchard, including in it the most promising varieties available, and then wait three or four years to determine which are the most successful, before setting out a large acreage devoted to any one variety. This experimental orchard need not contain more than two or three trees of a variety, and at present I do not believe one needs to plant more than a dozen varieties to be reasonably sure of getting the best that is available. The variety question is a rapidly shifting scene, anyway, and we see new ones coming to the front every year. There will, of course, be many people who will want to plant commercially without waiting for such a preliminary test as that outlined. To such we can only give the old admonition which treats of eggs and a basket; don't limit yourself to a single variety unless you are certain that you have picked a winner, and never be certain that you have picked a winner. Use several of the most promising varieties, so that in case one of them should not prove profitable, you will not stand to lose everything. To the end of this paper I append some notes concerning the more

promising varieties now being propagated in Florida.

George B. Cellon of Miami tells me that he finds the Guatemalans do not require as much fertilizer as Trapp and other West Indian varieties. There is cheer in this, but I hope none of you will take it as sufficient cause for ceasing to feed your trees. It is my personal belief that avocados in general need more fertilizer, particularly in regard to organic nitrogen, than they usually receive. I find that nitrate of soda is being used on avocados in some parts of Florida, and while I am not competent to speak with authority on the subject, I have a suspicion that nitrogen in an organic form would be much better. I wish some of you people who are on the ground and can give attenion to this matter would test it thoroughly and let us know the results.

Before going any further, I wish to pause for a moment to pay my respects to George B. Cellon. Some day we are going to appreciate his work. So far as Florida is concerned, he put the avocado on the map. He stands particularly high in my esteem because he was one of the very first to see the possibilities of the Guatemalan race. He obtained a collection of Guatemalan trees from California some years ago, and I suspect that the fruits produced by them were the first budded Guatemalans grown in Florida.

So far as the Miami region is concerned, the prospects of the Guatemalan race, when budded on the right sort of stock, looks very bright. On Mexican roots, the trees have proved to be very slow growers. On West Indian roots, which are the only ones being used extensively by the nurserymen at present, they do well. But the finest stock plant which we have yet seen at Miami is the Collins, a variety of the Guatemalan race. As a market fruit Collins is scarcely up to our requirements, but the tree is such a vigorous grower that we believe it is worth planting for the production of seed, which can be used to grow stocks for budding with the commercial varieties.

In the Palm Beach region the Guatemalans have not been tried so extensively as at Miami, yet John B. Beach has fruited a number of varieties and I see no reason why this section should not be an excellent one for commercial avocado growing. On deep, sandy land the trees will require much water, and preparations should be made by every planter to irrigate them liberally.

We do not yet know how far up the East Coast the Guatemalans will succeed, but we are recommending experimental plantings as far north as Merritt's Island.

The results obtained by Jack Taylor on Ritta Island, in the southern end of Lake Okeechobee, are so remarkable that we have co-operated recently in some further experimental plantings at several points around the shore of the lake. It is hard to say what effect the unique conditions of the Everglades region will have upon the avocado, but the way to find out is to plant some trees. The growth made by Taylor's trees at Ritta (they are all West Indian seedlings) is simply tremendous, and up to the present they are fruiting well.

In the Fort Myers region there are as yet very few plantings of Guatemalans. A tree of the Walker variety, growing in the yard of James Hendry at Fort Myers, is bearing heavily and gives every indication of being satisfied with conditions. By far the most interesting planting in this region is the grove of Harry Johnson near Bokeelia, at the north end of Pine Island. This grove, which is under the care of Vincent Honc, contains about forty varieties, and I have never seen finer trees for their age.

A question of outstanding interest is this: Can avocados be planted on land which is only a foot or eighteen inches above the permanent water level? It seemed to be the consensus of opinion among those with whom I talked that it is not safe to set out a grove on land where the water table stands less than three feet below the surface of the soil. We need observations on this subject. It has always been my own belief that the avocado is less tolerant of wet feet than almost any other fruit tree which we cultivate, and were I looking for an orchard site I certainly should not select ground which had less than three feet of "freeboard," if I may be permitted to steal this nautical term for horticultural use. It is also worth while in the Fort Myers region, and in many other parts of Florida, to look for soil which has a reddish, brownish, or yellowish color. Most of these soils are excellent for avocados.

Going north from Fort Myers, we find a considerable interest in avocados about Bradentown, due mainly to the efforts of the indefatigable Mr. Reasoner. In order to eliminate the frost menace as much as possible he has concentrated upon the Mexican race rather than the Guatemalan. A number of interesting varieties of this race, as well as several Guatemalans and the hybrid Fuerte, are receiving a test in this region and we will soon know what to expect from them.

The country between Winter Haven and Sebring impresses me as having excellent possibilities, once we have determined the proper varieties to cultivate. The extensive experiments of Mr. Niles at Lucerne Park and Mr. Carrier at Winter Haven should do much toward this end. It is my own feeling that we have, here in the Lake region, almost ideal conditions for the hardier Guatemalan varieties, and hybrids of the Fuerte type. A lusty Perfecto tree, fully 15 feet high, on Mrs. Stevenson's place at Avon Park, lends strength to the belief that this region is admirably suited to the cultivation of the Guatemalan avocados. There are several small groves of Trapps scattered through this region, but the experience of the past tends to make me believe that a Trapp grove in this part of Florida is a liability, not an asset. I could wish that all of these plantings in the Winter Haven region had been confined to Fuerte and a few of the best Guatemalan varieties. The experience of the first few years during which avocados are planted in any given region practically determines the extent to which they will be grown there in later years. If a beginning is made with Trapp, and the first plantings are killed out, people become discouraged and many of them do not

want anything further to do with avocados; if, on the other hand, the first plantings are devoted to varieties which are highly successful, everyone hears of them and immediately becomes interested in the possibilities of this new fruit. I must confess that I believe the Trapp has enjoyed an undue amount of prestige in certain parts of Florida. The fact that it has been the only fruit available during the early winter is in a large measure responsible for this. When they have seen the returns from the last few crates of Trapps shipped at the end of the season, —say in January,—people have forgotten all about the susceptibility of this variety to frost, its rather weak growth, and the fact that the bulk of the crop is picked long before high prices rule the market. To make this latter point clear, I may say that prices of $20 and $25 per crate are often quoted for Trapps late in the season but the average returns from two of the largest groves in South Florida, taking the entire crop, beginning in October and extending into January, have been $5.50 to $6 per crate. The point I wish to make is precisely this: In the case of Trapp, high prices are only obtained for the few fruits which hang on the trees until January, while the Guatemalan varieties will give us nothing but high priced fruit, if we consider this term to imply fruit which can be marketed during the winter months.

When we get north of Winter Haven we get into the *terra incognita* of avocado growing, in so far as everything except the Mexican race is concerned. We know that there are large trees of this latter within fifty miles of the Georgia line. We are gradually obtaining better varieties, and it may yet be practicable to extend commercial avocado culture into almost every corner of the state.

In regard to the relative hardiness of the different races, I can speak only in very general terms, inasmuch as there is a considerable range of variation within each race. Mr. Krome of Homestead, who is doing so much for the industry through his energetic study of cultural practices and the extensive variety tests which he is conducting, tells me that he has found Meserve and Oro, two Guatemalan varieties, to be as tender as the average West Indian. As a rule, however, the Guatemalans will stand three or four degrees more frost than the West Indians without injury. We hope it will be possible to grow the hardier of the Guatemalan varieties in those parts of Florida where oranges and grapefruit can successfully be grown, though it is as yet open to question whether this race is as hardy as the orange or the grapefruit. Several growers believe it is more nearly comparable to the lemon in hardiness. The Mexican race, in its hardier varieties, will certainly stand more frost than the orange, having passed through freezes of 18 degrees above zero without serious injury. In all cases the trees will stand much more frost when four or five years old than they will the first year or two after planting.

Returning to the question of stocks, nurserymen who are budding the Guatemalan varieties are using, as a rule, West Indian seedlings as stock plants. This is

chiefly due to the fact that Guatemalan seedlings can not be obtained in sufficient quantity for nursery purposes, and also because we do not yet know how many of the Guatemalan varieties are going to make good stock plants. Unless the trees are to be planted in particularly cold locations, there seems to be no objection to this, so far as we can see at present. In the avocado sections of Florida there is little danger of the root being killed by frost; it is nearly always the top that suffers, hence it is not dangerous to plant a Guatemalan variety budded on a West Indian root, provided it is budded low so that all parts of the plant which are above the surface of the ground are of the hardy Guatemalan variety. In California I have seen hardy tops budded high on tender stocks—two feet above the ground in some instances—and when the frost struck them the tops were not injured, but the stock plants were killed. It was a strange sight to see thrifty green tops upon dead trunks, and needless to say it was a sight which lasted only a few days, for the tops had to die. In regions where it is a bit frosty it would probably be desirable to have trees budded on Guatemalan roots, in order to insure as great a degree of hardiness as possible. We used to think that we could get a still hardier tree by budding on Mexican roots. We do not know, however, that this is really the case, and even if it is, we have found generally in Florida that the Mexican is not desirable as a stock, because of its slow growth and apparent lack of vigor when grown on this soil. Perhaps we will find certain varieties which will succeed as stock plants in Florida, and which will be valuable for the colder regions.

If I were planting an orchard of Guatemalan avocados today, I would ask nothing better than to have them budded on Collins stock; lacking this, I would not hesitate to take them on West Indian, if they were budded low, and I was in a region reasonably free from heavy frosts.

I come now to the question of varieties, and I feel the water getting deep. Before I finish with the subject you will probably see nothing more than a few bubbles coming to the surface; for if there is any question connected with avocado culture on which we must admit that we are still at sea, it is the matter of varieties. When anyone says to us, "Yes, I am interested in Guatemalan avocados, but what varieties shall I plant?" we are completely, entirely and effectively stumped. We can name a good many varieties which we would recommend you not to plant, but as for picking out the best ones, it is not so easy. As I stated previously, the only safe way is to test out the most promising ones in every particular region before going ahead with an extensive commercial plantation.

Naturally enough, I feel that the varieties we introduced from Guatemala a year ago are, in some cases at least, going to prove of value. If I had not thought some of them better than anything now growing in the United States I would not have climbed those hot Guatemalan mountain-sides so many times, nor punished myself with so many of those frightful black beans and those ghastly

tortillas. But they have not yet been tested in South Florida, and until they are we cannot recommend them for commercial planting.

On my recent trip through Florida I talked with most of the nurserymen, as well as the orchardists who are testing different varieties, and I wish to append hereto a list of what appear to be the most promising varieties, as far as can be judged at the present time. This is not a series of variety descriptions; it is a heterogeneous lot of notes and opinions acquired during conversations with nurserymen and growers, plus some of my own observations. I have not listed the varieties in their order of merit, for the simple reason that we do not know which to place at the top of the list.

Atlixco.—This variety was introduced into California from Atlixco, state of Puebla, Mexico, and from California was sent to Florida. It belongs to the Guatemalan race, and has recently fruited at Miami and Homestead. Mr. Krome considers it very promising. It is a strong grower, inclined to send up long shoots which do not branch very freely. The fruit is broadly pear-shaped, not necked, and weighs 20 to 26 ounces. In color it is deep purple. The flesh is of that rich yellow color which I consider essential to a first-class Guatemalan avocado, and the quality is excellent. At Homestead the ripening season is January and February.

Fuerte.—No other variety is attracting so much attention at the present time as Fuerte. In several respects it is the most remarkable avocado yet tested in the United States, and it seems likely to win a permanent place in the industry. Fuerte is unique in that it is a hybrid between the Guatemalan and Mexican races, the only one which we now have in cultivation.

Nurserymen have sometimes listed Fuerte as a Guatemalan. For several years, however, the conviction has been growing that it is a hybrid, and now that I have visited the town of Atlixco, in the state of Puebla, Mexico, and seen the parent tree, I am satisfied of its hybrid origin. We thought it might be represensative of a race which occurred in southern Mexico, and which was not yet well known to us. I found, however, that practically all of the avocados in Atlixco belong either to the Guatemalan or the Mexican race, there being no other varieties similar to Fuerte in character. We have evidence of its hybrid origin in several characters of the tree and fruit, and further evidence in the behavior of its seedlings. Some of the latter which are now being tested at Miami are very interesting. Fuerte itself has anise odor in the leaves, indicating Mexican blood. Some of the seedlings have the appearance of true Guatemalans, the foliage being entirely devoid of anise odor, while others seem to favor the other parent by taking on the character and appearance of the Mexican race. I do not believe this question is any longer open to dispute; Fuerte is a hybrid, and should be listed as such, in place of being classed as a Guatemalan.

Fuerte is one of the most vigorous growers we have. Mr. Krome finds at Homestead, however, that it is subject to

the avocado scab, and must be sprayed if it is to be kept clean. The feeling among nurserymen in this state seems to be that Fuerte will not be particularly valuable for Dade county and the Fort Myers region, but for sections farther north it is likely to prove the best commercial variety yet discovered. A grove of more than ten acres has recently been planted near Winter Haven. For Polk county I consider Fuerte especially promising.

The fruit is slender pear-shaped, green in color, weighs a pound or slightly less, and has a skin somewhat more thin than is common in the Guatemalan race. The flesh is rich yellow in color, contains more oil than that of nearly any other variety which has been planted commercially in this country, and is of rich, nutty flavor. The seed is small. The ripening season is not yet fully determined for Florida. Trees which have fruited near Miami have ripened their crops all the way from November to April. Some growers think the season is going to be November and December, which is slightly too early for the best markets; others believe it will be December or January to March, which would be ideal. In any event, it will probably be a month later in Polk county than at Miami. Fuerte is hardier than any other commercial variety yet planted; it ranks midway in this respect between the Guatemalan and Mexican races, and for this reason cannot be too strongly recommended for planting in those parts of Florida where there is danger from frost.

Gottfried.—This is a Mexican variety which originated at the Plant Introduction Garden in Miami, from a seed which was sent by a man living on Key Largo. I have never been able to understand how we came to get an avocado of the Mexican race from Key Largo, but we have it, and it looks like a good one. Gottfried is of importance mainly for the northern edge of the avocado belt, as it is hardy, and at the same time produces a fruit of good size, which latter feature is not characteristic of the Mexican race. The parent tree at Miami withstood a freeze of 22 degrees without turning a leaf.* As Mr. Simonds says, it actually seemed to enjoy the cold. Of course this tree is mature, and a young plant probably would not stand such rough treatment. The fruit ripens at Miami from August to October. It is oblong, about a pound in weight, with a thin, smooth skin and yellow flesh of very oily texture and rich flavor. This variety merits experimental planting in those sections where the Mexican race is the only one which can safely be grown.

Grande.—A variety which, like Atlixco, came to Florida from southern Mexico via California. It is showing up well at Miami, Homestead, and Winter Haven. It is a Guatemalan, and apparently as hardy as the average of that race. Mr. Krome considers it promising. It ripens in Dade county during late Decem-

***The temperature of 23 degrees was registered by a self-recording thermograph in the Plant Introduction Garden at Miami, February 3, 1917. A mercurial thermometer not six inches distant from the thermograph registered only 26.5 degrees. One or the other of these instruments was in error, and it seems more likely that the thermograph should be incorrect than the mercurial thermometer. Both instruments were of standard manufacture and tested by the U. S. Weather Bureau.**

ber and January, and is of good quality.

Knight.—A true Guatemalan introduced into California from Guatemala by E. E. Knight. So far as known, it has not yet fruited in Florida, but Mr. Knight states that its quality is good. It makes excellent growth in Florida, and should be included among the varieties to be planted experimentally in different parts of the State. It must be kept in mind by everyone planting Guatemalans that the habit of growth is one of the most important points to be considered in connection with every variety. Some are weak growers, others strong. No matter how good the fruit may be, a weak, straggling grower will not be a satisfactory variety to cultivate commercially.

McDonald.—Formerly called Beardsley. A Guatemalan variety introduced into Florida from Hawaii, where it originated. It has fruited at Miami and seems to be reasonably good. It is a strong grower, and bears round fruits, purple in color and about a pound in weight. The season at Miami is late, perhaps February to April. It is doubtful if this variety will be found among the commercial varieties of ten years hence, but it is worth a more extensive trial than has yet been given it.

Northrup.—A Mexican variety which originated in California. It is interesting to those who live in the northern part of the avocado belt, and who require the hardiest varieties obtainable. Northrup is a small fruit, pyriform, shining deep purple in color, with flesh of rich and nutty flavor. The tree is a strong grower and will probably stand as much frost as any avocado at present known to us. It is scarcely worth while for those who live in regions where the Guatemalans can safely be grown to plant this variety. Its principal virtue is its resistance to cold.

Perfecto.—Another Guatemalan variety which has come to Florida from southern Mexico via California. Mr. Krome tells me this has proved to be about the hardiest of all the Guatemalans he has tested at Homestead, having stood the cold as well as Fuerte. It is a good grower but subject to avocado scab, for which reason it must be sprayed frequently if grown in regions where the scab is troublesome. Mr. Krome says that the tree bears heavily with him, but he has not found the fruit to be of the best quality. The ripening season at Homestead is October and November, so far as observed up to the present. There is a fine tree of this variety on Mrs. Stevenson's place at Avon Park. I believe it is worth a more extensive trial than has yet been given it, particularly in the cooler portions of the avocado belt.

Puebla.—Although this variety has been listed in the past as a Guatemalan, it has proved upon examination to be a true Mexican. I picked fruits from the parent tree in Atlixco, Puebla, Mexico, in December, 1918, and was able to satisfy myself that there is no Guatemalan blood in the variety. It differs from the average Mexican only in its slightly later season of ripening. In California Puebla is attracting considerable attention because it ripens at a time when avocados are rather scarce — December and January. In South Florida, where many of the Guate-

malans ripen at this time, it is doubtful if Puebla will prove to be of great value. It seems more probable that it will be useful in those sections slightly too cold for the Guatemalans. It is a strong grower, and produces egg-shaped fruits weighing about eight ounces. The seed is rather large. The flesh is of rich flavor and excellent quality.

Queen.—Like the Knight, this is a Guatemalan variety introduced into the United States by E. E. Knight of California. It has not yet fruited in Florida, so far as known to me, but is recommended by Mr. Knight as being of good quality, and its behavior at Miami, Winter Haven and on the lower West Coast indicates that it is going to do well in Florida. It should be included among the varieties recommended for experimental planting in different regions.

Solano.—Mr. Cellon of Miami is propagating this variety extensively and recommending it for commercial planting. It is a Guatemalan which originated in California. As Mr. Cellon points out, it is a vigorous grower, making a strong, shapely tree, and it produces abundantly fruits of good size, form, and appearance. It ripens in early winter and seems likely to be a good commercial fruit. It is not as rich in oil as some other varieties, hence not quite so good in quality, but Mr. Cellon believes that it will prove satisfactory as a commercial fruit.

Taft.—This is a Guatemalan variety which originated in California. Its behavior in Florida has been somewhat puzzling; at Miami, where it was first tried, it did not grow well, but at Homestead it has made excellent growth, and Mr. Krome's trees are fruiting well. The objection to it in California has been that it does not come into fruit at an early age. It does not appear that this objection will hold in Florida. The fruits grown by Mr. Krome have been of large size and excellent quality. The season is midwinter. Mr. Krome considers Taft one of his very best varieties, and if it will behave elsewhere as it has at Homestead, it will be an excellent commercial fruit. I have seen trees doing well at Winter Haven, and in Johnson's grove at Bokeelia. All in all, Taft looks like one of the varieties it will pay to plant commercially in certain sections; but before putting out a large plantation in a section where it has not been tested a few trees should be planted experimentally and watched for several years.

Taylor.—We have as yet very few Guatemalan varieties which have originated in Florida. Taylor is one of the best of them. It was grown at Miami from a seed produced in California. It has fruited in several places and has proved to be a good variety, though it cannot be classed among the best. The tree is a reasonably strong grower, and the fruit somewhat resembles Taft in form and appearance. It is smaller, however, and perhaps not so good. It ripens at Miami from January to March.

Verde.—This is another variety which has come to Florida from southern Mexico via California. It is a Guatemalan, and a fruit which looks quite promising. The tree is a good grower, and the fruit is pear-shaped, about a pound in weight,

green in color, with a thick skin and flesh of very rich flavor. It has a relatively small seed, and I consider its quality to be excellent. It ripens at Miami from January to March. I believe it is worth testing pretty generally in Florida.

Wagner.—Though of more recent introduction into Florida, Wagner, like Taft, came to this state from California, where it originated as a Guatemalan seedling. I know very little about the Wagner myself, but Mr. Krome's confidence in its value makes me feel that it is promising. It is a good grower at Homestead, and produces fruits of nearly round form, weighing 19 to 20 ounces—occasionally up to 24 ounces. The color is green, the skin thick and brittle. The flesh is of good flavor and quality, though I would not rate it excellent. At Homestead the season of ripening is January to March.

Winslow. — A Guatemalan variety which originated at the Plant Introduction Garden in Miami. The parent tree is fruiting regularly in the Garden, and we have never considered the fruit to be of great value. At Homestead Mr. Krome has some budded trees in bearing, and he concurs in thinking the variety rather inferior. At West Palm Beach, however, it seems to have done much better. Mr. Beach gave me a fruit from his tree which I found to be of very good quality. I am forced, therefore, to suspend judgment on the variety, though its behavior at Miami and Homestead would deter me from recommending it for anything but experimental planting on a very limited scale. It is a small fruit, having at Miami a relatively large seed. The season of ripening is late; Mr. Beach tells me his tree does not mature its fruits until April or May.

Mr. Krome: I want to call your attention to this avocado (exhibiting avocado). It looks a good deal like a hand grenade. The avocado (or as most of you know it—the West Indian avocado), at the time it is sufficiently matured to be picked from the tree and allowed to ripen, is about as tender a fruit as we have to deal with. In shipping them we have to handle them almost like eggs; in fact fully as carefully. The Guatemalan is a different specimen entirely.

Question: What variety is it?

Mr. Krome: This is the Winslow. It is not particularly attractive. It is an avocado of fair quality, and the trees are prolific bearers, but it has a considerably larger seed than the average Guatemalan. The seed of the average Guatemalan is very small, in comparison with the West Indian. This, however, has a quite large seed, and a freeze of 26 to 28 degrees will cause the fruit to drop off, but will not hurt the tree. It will only cause the fruit to drop. Therefore, it is not a specially good variety for commercial use. As Mr. Popenoe says, we undoubtedly will develop varieties that are, in a great many cases, better than the best that we have now, but the Winslow is not going to be one of our standard varieties I am certain. It is worth while planting them. By using the Winslow, May and June, I have had avocados every month of the year. This (exhibiting fruit) is very

near the average size. Quite a number of the Guatemalans which have been fruited during the last few years, are larger than that. The market now calls for a larger avocado, and some of the Guatemalans that have been fruited during the last year—the Taft, Perfecto, Smith and one or two others—are avocados that ranged from one and a half pounds to almost two pounds. The general range of the larger varieties is from eighteen to twenty-six ounces. Those same avocados, strange to say, will run one-third smaller in California. An avocado which has fruited there for a number of years and established a result as having an average weight of about twelve ounces, we can bring into Florida and count on it being about an eighteen-ounce. Some of their Guatemalans out there which proved very shy bearers, were brought into Florida and proved very prolific. If there are any questions about Guatemalans that any of you care to ask, if I can answer them at all, I will be glad to do so.

Question: Can you plant the avocado on any higher land except under irrigation?

Mr. Krome: Yes. We think today that, except what we term in this state as low land, any avocado grove will be considerably benefited by irrigation. At present I don't know of but possibly three or four avocado groves which are actually irrigated. A number of the best producing groves along the lower East Coast have no irrigation whatever except the natural rainfall, and they are planted at elevations where the land is from eight to twelve feet above the standing water.

Mr. Niles: At Lucerne Park we had about fifty trees of the Pollock and Trapp. People coming from Dade county stated that they were as large trees as they ever saw for the age. They were six years old. Some were fifteen feet wide, and nearly that high. They were grown in Polk county, and had practically no irrigation. The trees were mulched with cowpeas or velvet beans that we could grow on the soil, and put around the trees. Up to the freeze of 1917 I doubt if there were any better avocados in Florida than those that were grown on those high pine hills. We felt that they would grow on those high pine lands very successfully.

Mr. Krome: I have never seen any land in Florida that was climatically suited for avocados, which I thought was too high, but I have seen plenty that I thought was too low. Even the low land will fool you once in a while. I have seen avocados on several occasions, young trees two or three years old, killed back by water standing above the ground roots for as much as two or three days. So if anyone asks as to planting avocados on land that is subject to overflow, I advise them to go carefully. I saw avocados that were planted on prairie land of south Dade county, which is overflowed during the rainy season. There was a canal which drained this land and kept it free of water ordinarily. This whole prairie went under water, and those trees went clear out of sight and stayed that way for five or six days. I would not have given five cents for the whole thousand trees. Two or three weeks afterwards I was on that

prairie, and those trees had come out of the water, and the owner informed me that they were doing better than before.

Question: I wonder if any explorations have been made in Chili. Down south in Chili, where it is cold, I found avocados planted. They are small in variety, about the size of a goose egg, and a long way south of where I found oranges. I found no oranges until I got to Santiago, and I took a few specimens to see if I could plant the seed, but way down south, in the ———— Valley of Chili, I found avocados, and knowing the transportation facilities of that country, I doubt very much if they have been shipped very far north. In all South America I have never seen large fruit groves. They are in scattered bunches. As you go on further north, up into Peru, the avocado gets very much larger. The avocado is a high priced fruit there, as compared with other fruits, although very cheap as compared to what it would be in this country. It seems that they would have varieties down there that would grow in Georgia and the Carolinas, and it seems that it might be well to investigate that country before feeling that you have the most hardy varieties.

Mr. Krome: A number of years ago a number of seedling Peruvian avocados and one or two Chilian were brought into this country. They sent me several Peruvian and I think two Chilian. The Peruvian fruited, but I never got any fruit from the Chilian. The Peruvian were distinctly of the West Indian type. The Chilian gave evidence, in their foliage, of being also of the West Indian type, but what their fruit would have been we could not determine. I don't know what part of Chili they were from.

Mr. ————: I have grown a few experimental avocados at my place in Texas, under irrigation. I got them from California, and we have a sandy soil, well drained, and I can hardly put on too much water for them. I found it absolutely necessary there to mulch the soil. Those that I did not mulch died. Those that I did have grown well.

Question: For the culture of these would you advise the use of commercial fertilizer, or use something like stable manure?

Mr. Swingle: Use the stable manure as a mulch, or some other organic stuff.

Question: One could not depend altogether on commercial fertilizer?

Mr. Swingle: Yes, you could depend altogether upon commercial fertilizer, and probably have a very good avocado growth, but stable manure, as a compost on avocados, is hard to beat, but it is also hard to obtain in quantities necessary. We have tried out a good many avocado fertilizers, and the fertilizers compounded of organic materials containing cotton seed meal and blood and bone, have workd very well with avocados. That will not hurt your tree any. You will not get the same amount of value from it that you would on the citrus tree, nor that you would on the avocado from the organic.

Avocado Varieties

E. D. Vosbury, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

In the past two years there has been a steady increase in avocado planting in South Florida and there is no longer any doubt but that avocado culture will be of considerable commercial importance in this State.

One of the most important questions to be settled in starting a new fruit industry of this sort is that of selecting the best standard varieties to plant. This is particularly true in the case of the avocado, of which there are nearly two hundred varieties growing in this country. It is very essential that as soon as possible this large list be narrowed down to a few of the best sorts and all inferior varieties eliminated.

It is not yet possible to suggest such a definite list of standard varieties for Florida as many of the most promising sorts are only fruiting here this year for the first time. These include some twenty or more varieties secured by Mr. Wilson Popenoe, and others, of the United States Department of Agriculture after a thorough search through the mountains and lowlands of Guatemala and other regions. In the next three or four years, therefore, it appears probable that we may learn more about avocado varieties and their culture than in all the past years during which they have been grown in this State.

No new variety of avocado can with safety be planted extensively until it has been carefully tried out for each locality, and prospective growers of limited capital should keep this fact in mind. On the other hand small test plantings of the most promising varieties are highly desirable. The avocado nurserymen of Florida as a class are encouraging the development of the industry along conservative lines, and several of them are conducting, at considerable expense, experiments of greatest value to the growing industry. A number of individuals, aside from the nurserymen, are conducting valuable experiments with avocados. Among these may be mentioned Mr. H. P. Johnson of Fort Myers, who is carrying on a very large test with avocado varieties which promises to be of immense value to South Florida.

While our knowledge of avocado varieties is still far from complete, there are some varieties which have been sufficiently tested to show that they are valuable for commercial planting. It is my purpose to sum up briefly our experience with these varieties here in South Florida.

As most growers are aware, the many avocado varieties grown in this country

may be conveniently grouped into three great classes or types, namely: the West Indian type, the Guatemalan type, and the Mexican type. Almost all of the avocados seen in Florida are of the West Indian type or race. The Guatemalan sorts were first introduced here in 1912 and except for a few seedlings none of the Mexicans were grown here prior to five years ago.

WEST INDIAN TYPE.

Varieties of the West Indian type have fruits which vary greatly in size, shape, color, and season, but all have a thin skin. This type seems to have originated in the lowlands of Central America. All of the West Indian varieties are quite tender, withstanding even less cold than the common guava or the Key lime. On account of their tender nature the commercial planting of avocados of this type should be restricted to the most tropical parts of South Florida, such as the coastal regions of Dade, Lee and Palm Beach counties. Small home plantings may be made with reasonable safety somewhat farther north, and occasional trees have fruited well for many years in sheltered dooryards as far north as Orlando. In these colder sections, however, the hardier Guatemalan sorts will doubtless prove more suitable.

Trapp.—The chief West Indian variety so far developed is the Trapp, which constitutes more than 75% of all the Florida plantings. The season of the Trapp is September to December. The tree usually produces good crops, although this year there are very few Trapp in most sections, owing to a heavy rain at blossoming time. Although Trapp is only fair in quality, and the tree is often a weak grower, it is generally considered a profitable variety.

Walden.—A West Indian variety of considerable interest, which originated in Dade county. The fruits appear to mature somewhat later than Trapp and are considered higher in quality. No fruit of this variety has matured to date, except on the parent tree, but the young budded trees are very vigorous and apparently somewhat hardier to cold than Trapp.

The Baker, originating at Ojus, and the McKean, originating at Fort Myers, are other very late fall varieties of promise.

Pollock.—A summer fruit of high quality, maturing in August and September. On account of its quality it is considered an excellent home garden sort, but is too shy a bearer to be valuable for commercial planting.

Butler.—A summer fruit of fine quality which has been propagated to a limited extent. Its season is August and September, and the trees have so far been vigorous and productive.

So far in the avocado game but little attention has been paid to the selection and planting of summer varieties. Most growers have paid all their attention to the fall and winter sorts. Doubtless these late varieties will bring higher prices for some time, but as the avocado industry develops, more and more demand will result for the summer sorts as well. The avocado grower who has good varieties maturing in summer will be able to

distribute his labor to better advantage, and will also be better able to secure and hold his customers than the grower who has only the late sorts. For these reasons I believe that every planting of avocados should contain at least a few trees of some good early variety.

GUATEMALAN VARIETIES.

The avocado varieties of the Guatemalan type have been recently introduced into this State and are now the center of interest among growers. In California the West Indian varieties are too tender and the Guatemalan varieties are grown instead. Here in Florida the Guatemalan varieties, on account of their late season of maturity, as well as their relative hardiness, are both interesting and promising. Guatemalan fruits in contrast with the thin-skinned West Indian fruits have a rough, leathery, or shell-like skin. They vary greatly in quality, the best sorts being equal or superior to the West Indian varieties.

In Florida the season of the Guatemalan varieties extends from December to May. In hardiness they vary greatly, but as an average they will withstand 3 to 5 more degrees of frost than the West Indian sorts. The Guatemalan varieties so far tested, however, are in no sense frostproof. Most sorts are nearly, or quite, as tender as the lemon. Several of the recent introductions of the United States Department of Agriculture, however, were brought from the mountain tops of Guatemala where freezing weather is not uncommon. Some of these may prove considerably hardier than those so far tested. Until further evidence has been secured on the relative hardiness of these Guatemalan varieties commercial plantings should be restricted to localities as warm as the highlands of Polk and Pinellas counties. For home planting Guatemalan varieties appear promising for trial in the most protected sections of Orange and Lake counties. Of the fifty or more Guatemalan varieties now being tested in this State only a few have fruited sufficiently to indicate their real merit. Among these the following varieties have shown considerable promise for commercial culture:

Taft.—This variety has fruited several crops in Florida and is one of the most promising so far tried. Its season is February to April and the fruit is of good size and excellent quality. In California Taft has been included in the list of standard varieties for that State.

Taylor.—This variety originated as a seedling at the Plant Introduction Garden at Miami, Florida. Its season is January to March, and several crops have been harvested from mature trees in Dade county where it is considered profitable and promising as a commercial sort.

Fuerte.—Another promising Guatemalan sort. On young trees the fruit of this variety has had a disappointing tendency to drop before mature, but on older trees the fruit appears to hold much better, so that it may be harvested in February and March. The quality is high and the trees vigorous, hardy, and productive. In California Fuerte is the leading standard variety. Here in Florida Fuerte has a tendency to be afflicted with

anthracnose and should be sprayed with Bordeaux at blossoming time.

Among other promising varieties which have fruited in Florida are *McDonald*, a late purple fruit of excellent quality; *Wagner*, a March fruit of fair quality; *Atlixco*, a purple-fruited March variety of excellent quality; and *Solano*, a vigorous growing variety with green fruits of fine quality. *Solano* has so far matured in November, a season somewhat early for the Guatemalan type, but it is thought that the season will be later as the trees become more mature. *Collins* is a very small fruited variety hanging on the tree until April and May. It is too small for commercial planting but is high in quality, and may be recommended therefore as a variety for home planting.

MEXICAN TYPE.

The varieties of the Mexican race are the hardiest of all of our avocados. Many of them are apparently as resistant to cold as the round orange and several seedling trees of the Mexican type have fruited for years as far north as Waldo and Gainesville. Unfortunately most Mexican varieties are too small fruited for commercial trade. Some of them, however, are of excellent quality and on this account, as well as by reason of their hardiness, they are well adapted for home planting, especially in the northern citrus sections of Florida, where the larger fruited varieties are too tender. Furthermore, some of the recently introduced Mexican sorts promise to bear much larger fruits than those hitherto grown. It is possible also that very valuable hybrids may be obtained by crossing some of these hardy Mexican varieties with standard Guatemalan and West Indian sorts.

Puebla is one of the most promising of Mexican varieties. The tree is a vigorous grower and the fruit is excellent in quality. While somewhat small (12-14 oz.) the fruit is still large enough to be commercially valuable. San Sebastian is another Mexican variety of much interest and promise, which, like Puebla, is just bearing fruit this year in Florida for the first time.

Harman is a variety which ripens at Miami in July and August. Though small in size Harman is rich in oil and excellent in quality.

Gottfried is a large fruited Mexican originating at the Plant Introduction Garden at Miami. It ripens in September and the fruits are large and of excellent quality.

STOCK.

One of the most important problems which must be worked out in connection with this study of avocado varieties is that of the relation of variety and type to stock. Most varieties planted in Florida have been budded on West Indian stock, although there are marked indications that some of the Guatemalan varieties at least will thrive much better when propagated on Guatemalan stock. Mr. Edward Simmonds, of the United States Seed and Plant Introduction Station of Miami, has noticed, for example, that some Guatemalan varieties when budded on Fuerte make a very much better

growth than where they are propagated on ordinary West Indian seedling stock. It is also quite probable that a hardy variety will not be equally as hardy when budded and planted on tender West Indian stock as when planted on a hardy stock such as Mexican or Guatemalan.

The whole question of relation of stock to type is of such great interest that several test plantings have been started by representative nurserymen in co-operation with the United States Department of Agriculture, and it is believed that valuable definite information will be available in a few years.

In planting avocados it must be remembered that regardless of the variety the young trees must have proper care and attention. Every year thousands of valuable budded trees are lost in this State through sheer neglect. Young trees cannot be expected to thrive when planted in hot dry soil and left to shift for themselves. I know of no fruit which responds more cheerfully to good care, or which slumps quicker when neglected, than the avocado. It is an excellent plan to cover the ground well out as far as the roots extend with a thin mulch of hay, weeds, or other similar material, which will serve to keep the ground moist and cool, and eventually add humus to the soil. Many growers use this mulching system with excellent success.

The native home of most sorts of avocados is in regions with rich moist soil, and here in our dry Florida soils the trees usually need additional water and fertilizer, especially during the first season or two after they are planted.

In conclusion it might be well to emphasize the fact that the avocado as a home fruit has no equal in regions where it may be grown. I believe that every home in the Florida orange belt should have a few trees in the dooryard for the family supply. In the most tropical localities of South Florida it is now possible to select a list of fine varieties which will furnish fruit practically all the year round, beginning for example with Harman in June and ending with Collins the following May. Even in the North Florida counties a few of the hardy Mexican sorts might be grown in sheltered dooryards. In addition to supplying valuable food these small home plantings will serve as useful and interesting test plots for each locality.

Climatic Limitations on Avocado Growing in Florida

J. B. Beach, West Palm Beach, Fla.

When we began to consider the possibilities of avocado growing by the introduction of the hardier Guatemalan and Mexican strains a few years ago, we did so at a most unfortunate time. Just as people throughout the orange belt began to try a few trees as an experiment, along came one of our unusually severe winters, and the little trees just planted were pretty generally killed. Many tried again, and were visited by a second severe winter, and generally became discouraged, and gave the matter up as a bad job. This result is very natural, and it is a misfortune which cannot be helped, and could not have been foreseen and prevented. I will confess that I was caught myself.

After the cold winter of 1917, I believed, according to the law of probabilities, we were entitled to one or two mild or normal winters and planted a few hundred Mexican and Guatemalan trees without protection on Indian river, where I have an interest in an orange grove. They were set in November, and though my partner made some attempt to save them by banking, I believe he was too late, and at any rate he failed to save them. Many afterwards sprouted from the grafts, but all finally died, partly perhaps owing to unusually dry weather. I think he was so disgusted by their freezing he neglected to water them, which contributed to their total loss. However, a customer of mine planted a lot at Arch Creek about the same time, encouraged by my example, and had a similar experience, the sprouts from the graft nearly all finally dying out. We gambled on the weather, and failed to realize how much more susceptible a newly planted tree is than one that has become rooted and established, and lost out, like many others.

I have heard of a number of instances in parts of Florida where colder winters are expected, where young, newly planted trees were brought safely through both winters, by giving them adequate protection. I cannot say that a young Guatemalan avocado bud is more tender than a citrus bud of the same age and size, but there cannot be very much difference in either direction, and it is very unfortunate that more of us failed to realize this fact sooner.

When California is able to grow avocados extensively there is no good reason why we cannot do the same. I shipped several thousand trees of the West Indian type (mainly Trapp and Pollock)

to that state in the falls of 1912 and 1913. A few years sufficed to prove that the type was too tender for that climate. However, all the avocados, practically speaking, which have ever fruited in Florida or appeared in the eastern market, for that matter, are of this type, and we can point to very large, old trees, as well as hundreds of acres of younger bearing groves, to prove that Florida climate is not too cold for them. If we took anything like the pains to protect our trees from cold that they do in California, there can be no doubt about our ability to establish bearing groves of the hardier strains that will grow all over the orange belt.

It would be a great mistake to abandon the game now. We should try again, and in each instance protect the young trees sufficiently to save them from such cold as visited our locality in the winters of 1917 and 1918. The cost is relatively small, compared with the value of the grove, when once established, and there can be little doubt about their holding their own, when once safely past the second winter.

We have had very little experience to go by on the Guatemalan strain, but we know how much the West Indian trees gain in hardiness with age. For instance in 1918, south of Miami, young West Indian trees set within the preceding 18 months were generally killed to the ground, while trees 3 years old and up suffered relatively less in proportion to their age and size. Old bearing trees often came off "scott free," and anyhow only lost foliage and small branches, sometimes only reducing the crop, and never jeopardizing the crop for the ensuing year. I did not see any Guatemala type trees either young or old noticeably affected by the cold. Probably they will be as safe from Polk county south, as the West Indian are on the lower East Coast, while in certain protected spots, where West Indian seedling are now growing, budded trees of this type may be safely planted.

The existence of some large Mexican type seedlings, 40 feet or more in height and about 25 years old, near Waldo, Alachua county, and which produce regular crops of fruit, proves conclusively how far north this type may be grown. The fruit of this strain possesses higher food value than that of either of the others, as its proportion of fat averages greater by 5% to 10%. The fruit is usually very small, and the flavor not quite as delicate as the other types, but these defects are being remedied by the introduction of improved varieties. The Gottfried, introduced by the United States Department of Agriculture, fruited at the Miami Experimental Station last summer, and a specimen which I had photographed, weighed 19 ounces. The flavor was good, and superior to any of that type I had tasted, and some people who tried it pronounced it superior to the common fruit of the West Indian type, which at that time was plentiful in the home market. For my own part, because of being already accustomed to the flavor of our common fruit, which runs from 12% to 18% fat, the richer Mexican with 22% to 30% does not appeal to

my fancy, but I believe it is merely a matter of education. Given a fruit of as good flavor as the Gottfried, I think one who had never tasted either, would likely prefer it to a Trapp or Pollock. Anyhow, the question of food value is undeniably in its favor, and it would be well worth planting for home use as well as for local markets, where the other types could not be safely planted.

One of the great features which favor the Guatemalan type for market planting, is that its normal ripening season is half a year later than that of our common West Indian, and I believe our growers will make a grave mistake if they allow themselves to remain discouraged by the losses of the past winters, and fail to plant, and adequately protect some of these trees. We have a milder climate than California, and there is no excuse for us to allow that state to monopolize the winter avocado business because we are too parsimonious to spend a little money in protecting our young trees, as they do, at an expense much greater than ours would be here.

Some Troubles to Quarantine Against and Their Nature

L. Russell Warner, State Plant Board, Orlando, Florida.

Up until very recent years the only protection the United States had against the introduction of injurious insects and diseases was the hand of Providence. That Providence could not cope with the situation unaided is attested by the fact that today the total annual loss occasioned by introduced insect pests to our national forests and to farm crops amounts to approximately $500,000,000 a year. The bulk of these introductions has been with living plant material of all sorts. Every year one or more new pests appeared. The Gipsy and Brown Tail Moths have extracted their toll from our forest and farm resources in New England for years, and their control costs more than a million dollars a year alone. The San Jose Scale has been with us for some 40 or 50 years, and today costs $10,000,000 annually for spraying and apparatus alone, let alone reduction in crop yield. The oriental peach moth introduced from Japan in 1912 has just begun its spread and depredations, and as it affects practically all deciduous fruits it bids fair to be much more destructive in the long run than the San Jose Scale. Losses correspondingly large are chargeable to introduced plant diseases. The chestnut blight, which has already destroyed much of the chestnut forests in the eastern United States, and the white pine blister rust, a disease already widespread in the eastern white pine area, are the result of imported nursery stock, the entry of which should have been restricted and safeguarded by quarantine. The principal hindrances to citrus culture in Florida, namely the common white fly, the cloudy winged white fly, the wooly white fly, the purple scale and citrus scab, among many others, could have been kept out of our groves had Providence been supplemented with our present quarantine service.

The citrus canker experience finally aroused us to the danger of insect and disease importation for all time. What we discovered through canker, California had figured out 25 years ago, much to her subsequent satisfaction. The federal government for years had realized the need of quarantine measures but it was not until after 25 years of effort that the Federal Quarantine Act of 1912 was passed by Congress. Not, however, before citrus canker had gained entrance. If such a heart-rending and expensive experience can be called a blessing in dis-

guise it was the most highly camouflaged one in history. The result was the Florida Plant Act of 1915, an act to prevent the introduction into and dissemination within the State of injurious insect and disease pests. Section 5 of this act provides that the State Plant Board "shall keep itself informed as to known varieties of insect pests and diseases, the origin, locality, nature and appearance thereof, the manner in which they are disseminated, and approved methods of treatment and eradication." It is concerning a few of these insects and diseases that I wish to speak to you particularly in order that you may realize the seriousness of some of the pests that the Quarantine Department is trying to keep from entering our groves.

Before speaking of the pests without our gates I wish to generalize for a moment on the way in which introduced pests always adapt themselves to new conditions. In practically all cases they are worse than in their native homes. This is due in part to the fact that when transplanted to a new environment their natural enemies do not go with them. Witness the cottony cushiony scale. Until the Australian Lady-beetle was introduced from Australia, the scale could not be coped with. Climatic conditions also favor them as I will mention later in speaking of the brown rot of lemons. Often resistant strains or varieties develop in their original habitat against which the pests are not so virulent. In Japan, although citrus canker had been present for years, it was actually thought that the disease had been introduced from California because some introduced Washington navel trees were so susceptible to the disease that it attracted attention on them rather than on the native trees. Japan's own susceptible varieties had evidently succumbed long before. Again in new environments insects change their feeding proclivities. The Mexican boll weevil may have originally fed upon a wild plant other than cotton, but when brought in contact with cotton forsook its original host. The Colorado potato beetle, a native of the Rocky Mountain region, was satisfied until 1855 with feeding upon wild weeds, but with the introduction of the Irish potato transferred its fickle affections. Again, among the fruit flies we have instances where in the absence of the favorite host and in the event of a great number of the insects being present they turn to other fruits than their preferred one and do great damage. Finally, variations or new strains are always appearing in insects and diseases that are capable of existing on new hosts. You all know that there was a time when grapefruit was reported as immune to citrus scab. Now grapefruit is not only a favorite host, but the disease is becoming more and more prevalent on sweet orange. Therefore we must quarantine against every seen and unforeseen danger. Everything of even a doubtful nature must be kept out.

Of the pests that exist in our own country we are especially afraid of the citrus canker in the Gulf States, the brown rot of oranges and lemons in California and the Gipsy and brown tail moths of New England. The brown rot of oranges and lemons is especially to be

kept out. Prof. Coit of California, in writing of it states that all citrus fruits are affected by it. The decay spreads rapidly in the packing houses as the mycelium of the fungus is able to infect perfectly sound fruit by contact. If not discovered and removed, the decay starting from one lemon may run through an entire box or a stack of boxes in storage, and in a short time, reduce the whole to a watery mass. In the California groves it does considerable damage to the fruits while still hanging on the tree. Such a serious pest in dry California must by all means be kept out of our own humid State. Our quarantine which excludes citrus fruit and citrus nursery stock from California on account of the brown rot, also protects us from the citrus blast, a new and destructive bacterial disease of citrus in California. The Gipsy moth has been a pest of prime importance in New England for more than thirty years. In 1868 it was brought to Medford, Massachusetts by a French scientist who was interested in silk producing experiments. Some of the caterpillars escaped, and in 1890 the caterpillars had become such a serious pest in twenty towns that the state of Massachusetts began a campaign of eradication. For ten years the fight was carried on and with such success that public opinion ceased to demand its extermination and legislative appropriations were discontinued for four years, during which time the moth spread to over four times the area previously occupied and became so abundant that state action was again necessary. It has now spread to New Hampshire, Maine and Connecticut and the Federal government and Massachusetts each spend $300,000 per annum for its control in that state alone and the total cost to New England is more than $1,000,000 annually. Another undesirable moth is the brown tail moth, which was introduced into Massachusetts from Europe in 1890. Not only does it do great damage to the orchard and shade trees of New England, but the larval hairs which are shed and fill the air at the time of transformation of the insect from the caterpillar to the chrysalis stage have an intensely irritating or nettling character. They blow through the air, settle on the neck, face and hands of human beings and produce a rash like that caused by poison ivy, and this irritation, in one or two instances, and perhaps in others, has been the cause of death by affecting the lungs and leading to fatal cases of tuberculosis. Should the brown tail moth reach the South this irritation to human beings would doubtless be increased by reason of greater warmth and by the moisture of the skin and consequent greater likelihood of adherence of the larval hairs.

Of the orchard pests of the wide world, not known to be residents of the United States, there are many undesirables. Although we have 87 different scale insects in Florida, we are still relatively poor in numbers. But our greatest matter of congratulation is in the fact that we have so far escaped the serious fruit flies. Most of the fruit flies attack the fruit only. The adult females puncture the skin of fruits and vegetables and lay their eggs inside. Often the infestation is so hard

to discover from the outside appearance of the fruit that only after it has been cut or bitten into is it discovered that the inside is a seething mass of maggots. These maggots pupate in the ground or under some suitable shelter, and the next generation of the adult flies appears. On account of the fact that the adult is a fly often of about the same size as our common house fly and because of the fact that the eggs and larvae are not exposed, control and eradication always prove an all but hopeless task. In the North there are five deciduous fruit flies from which we need little fear. The fruit flies of the tropics are our great enemies. Although the papaya fruit fly is established around Miami and on the lower keys, there are still some twenty known varieties of tropical and sub-tropical fruit flies that are not in the United States. First and foremost of these is the Mediterranean fruit fly, *Ceratitis capitatis* Wiedemann.

This fly has been known for more than one hundred years. It first attracted attention in London when oranges from the Azores, Canary, Cape Verde and Madeira Islands were found to be decayed, wormy and unfit for food. Subsequently it has appeared in every large land body except North America. It is in the Mediterranean countries, in northern and southern Africa, in Paris, France, in Australia, in Argentina, in Brazil, in New Zealand, in Hawaii and the Bermudas among other countries. In the Hawaiian Islands seventy-two hosts are infested. If this pest were introduced into Florida it would find the same climatic conditions to which it is accustomed and would wreak terrible damage to the orange, grapefruit, mango, avocado, tomato and every other thin-skinned fruit and vegetable in the State with the possible exception of green bananas, pineapples and strawberries. The adult female stings or punctures the fruit with her ovipositor and deposits her eggs beneath the skin in some numbers. A single female has been known to lay as many as 300 eggs. The eggs hatch in from two to five days, the growing maggots then excavating galleries in the fruit and feeding upon the pulp. In ten to fifteen days the maggots complete their development, emerge from the fruit and bury themselves beneath the tree, where they transform to the pupal stage. After ten to thirty more days, depending upon climatic conditions, the adult fly emerges, ready to begin again its destructive work. It will be seen from this that the pest can undergo from six to twelve generations per year, and when we consider that each female can deposit as many as 300 eggs, it is easy to understand the destruction that may be accomplished. The larvae of the Mediterranean fruit fly are identified by a habit they have of jumping several feet when removed from the fruit in which they are feeding. By this habit they are enabled to reach a suitable place for pupating. They are extremely hardy. Experiments carried on in California show that the maggots can remain for a period of 17 weeks in salt water, changed daily, or seven hours in absolute alcohol and still pupate and become adults.

Another fruit fly of perhaps equal or greater importance to the citrus grower is

the Mexican orange maggot, (*Anastrepha ludens* Loew., also called the Morelos fruit worm. This fly attacks citrus fruits, sapodillas, peaches, guavas, plums and mangos. The life history is not unlike that of the Mediterranean fruit fly, except that the female only lays about seventy eggs, and there are four broods yearly, as the life cycle requires about three months. In certain localities of Mexico the production of oranges has been abandoned on account of it, and the mangoes in such districts have been reduced to about one-fifth of the normal crop.

Of the twenty fruit flies I would like to mention the melon fly, *Dacus cucurbitae* Coquillet. This fly extends from Nagasaki, Japan, to Queensland, Australia, north and south, and from Bombay to the Hawaiian Islands, east and west, showing by its range that it is undoubtedly qualified for Florida conditions. In the Hawaiian Islands it is impossible to raise muskmelons, green beans, tomatoes, cucumbers, squash, pumpkins, watermelons and other vegetables except each vegetable be protected by a paper envelope. It is also on record that this fly has been bred from the fruits of the mango, orange (?) and papaya. The adult flies often lay their eggs on the young fruits before the blossoms fall. Severin gives the life cycle of the melon fly: minimum 29; maximum 43 days; and records the rearing of 637 melon flies from a pumpkin four inches long. Dr. E. A. Back, one of the world's greatest authorities on fruit flies, asks if this pest can be kept out of the rich tomato plantations of Florida.

As near as Cuba, exists the West Indian fruit fly, also called mango fruit fly, *Anestrepha fraterculus* Wied. This fly is a native of the West Indies, and is established in Mexico, Central America, Colombia, Brazil, Argentina, Peru, Cuba and Porto Rico. So far it is not known to be established in the United States, but Dr. Back states that it could easily become a serious pest in Florida and the Gulf States. In an article in the December, 1918, number of the Journal of Economic Entomology, entitled, "*Anestrepha fraterculus* Wiedemann (*Trypetidae*). A Serious Menace to the Southern United States," gives a great deal of valuable information on this pest. Rust lists the hosts as guavas, coffee berries, peaches, mangoes, oranges, Japanese plums, Japanese persimmons, Para pears, Jobo amarillas, Jobos de la India, *Eugenia* sp. *Phylocalyx*, to which list may be added pomelo, fig, kumquat, tangerine, apricot, avocado and custard apple. The life cycle of the fly depends upon the season of the year, but under suitable conditions it could be completed in 30 to 35 days. In Cuba the principal host is the mango, and after June first it is hard to find a mango that does not have maggots in it. These maggots are called "Bicho de San Juan" by the natives, meaning "Worm of St. John," and the name is probably derived from the fact that St. John's day in June is celebrated as a holiday and when the people go out into the country they find the mangoes infested on this day. Mr. Cardin, entomologist at the

Experiment Station at Santiago de las Vegas, Cuba, told me last May that he remembers that the mangoes were infested at Artemisa, Cuba, as far back as 1890, and that the fly was probably a pest in Cuba long before that. I saw two surinam cherry trees so infested at the Experiment Station at Santiago de las Vegas that it was impossible to find a cherry that either did not contain a worm or that was not punctured by the ovipositor of the fly. In Cuba the citrus fruits are not infested, but this is probably due to the great abundance of mango trees and other hosts. Dr. Back reports oranges as being infested and Prof. C. L. Marlatt has records of the fly being bred from the orange and grapefruit, but not as preferred hosts, only being used by the fly in the absence of the preferred hosts. That it may become a serious citrus pest under certain conditions is shown by Mr. Rust in the article previously referred to.

He states that in Argentina the apricots are first attacked in the spring, and then the peaches, which are the principal summer host of the insect. By the end of the peach season the flies have reached their maximum number, and there are scarcely enough host fruits for the flies to oviposit in, with the result that any kind of fruit is used for the purpose, although the larvae can only develop in certain kinds. Later fruits such as custard apples and guavas each serve as a host for one generation of the insect. Persimmons help the flies to survive until oranges are ripe for attack. Numbers of the eggs deposited in oranges are destroyed by essential oils liberated in the orange peel by the punctures of the fly, while many larvae starve to death before they can reach the pulp that they require for nourishment. However, fruits that have been punctured by the *anastrepha fraterculus,* even though no oviposition takes place, are frequently destroyed by the Colletotrichum, other fungus spores and by bacterial rot that enter the abrasions. During the autumn of 1918 a loss of nearly 50 per cent of the oranges of some sections was experienced. Very few parasites of the fly have been found in Argentina, and artificial measures, as in the case of all fruit flies, have not proved very successful.

As I stated before, this fly is not known to occur in Florida in spite of the closeness of the infested countries. Last month, Prof. John R. Johnston, chief of the Office of Plant Sanitation in Havana, while paying a brief visit to Key West, expressed great surprise when told that we had not as yet discovered it in Florida. In view of Mr. Rust's observations, I believe that if it became established in Florida it could prove a serious pest, not only of mangoes, guavas and other thin-skinned fruits, but of the citrus fruits as well. I make this deduction from the fact that we do not have the complete cycle of thin-skinned fruits in great abundance as in Cuba and Argentina. The fly would therefore reach great abundance during our guava and mango seasons, but in the intervals, in the absence of peaches and other fruits little grown in Florida, the citrus would be resorted to.

Dr. Back says that Florida's greatest source of possible infestation from the Mediterranean and other fruit flies lies in

the West Indies. At present the islands of the Caribbean sea are not known to be infested with the Mediterranean fruit fly, but with the development of fast steamers, cold storage refrigeration of fruits, and with the opening of the Panama Canal, cargoes have been and will be shipped from Honolulu to the east, and from Australia. Spanish boats have been plying between Spain and West Indian and Mexican ports, and even Galveston and New Orleans. As seen on the map, Florida is so surrounded by the Islands of the West Indies that were the peninsula cut across we would be one of them.

Numerous instances of fruit fly spread can be shown. The Bermudas would not now be infested in all probability by the Mediterranean fruit fly had not a sailing vessel, in 1865, bound from the Mediterranean region with a cargo of infested fruits for New York, been blown from her course and forced to land her cargo and the fruit flies with it at St. George. The same fly did not become established in Australia until infested oranges were shipped by steamships and cold storage from the Mediterranean countries to Perth and Sydney. With the establishment in eastern Australia it was an easy matter for it to be carried by ship's stores to Honolulu, and today the California inspectors make interceptions monthly of infested fruits in the stores of ships from Hawaii and in the personal baggage of passengers arriving from Honolulu at San Francisco and San Pedro.

We all know the way in which the white flies devitalize the trees by sucking the juice from the leaves, and of the sooty mold and the purple scale which follow and accompany the presence of the white flies. The direct result of heavy white fly infestation is the production of small, dry and dirty fruit. It is known that there are at least sixteen species of white flies in the world that attack citrus. Of these there are nine in the United States, five of them being native. The native species are not serious, but of the four imported ones I need only mention that they include the common white fly, cloudy winged and wooly white flies to indicate how destructive they are. Of the seven white flies that infest citrus and which are still beyond our borders, by far the most to be feared is the spiny citrus white fly, *Aleurocanthus woglumi* Ashby, also known as the black fly on account of the slate colored appearance of the adult and the shiny black color of the larvae and pupae. What citrus canker is among diseases of citrus this pest is among insects. The black fly occurs in Ceylon, the Philippines, the Panama Canal zone, the Bahamas, Jamaica and Cuba. It infests practically every tropical and sub-tropical fruit tree and so far no eradication efforts have been able to hold it in check. As Mr. Wilmon Newell presented a paper on the subject at the last meeting of the Society in Ft. Myers, I will not deal with it further, except to state that in the Bahamas and Jamaica all eradication efforts have been abandoned as hopeless.

There are a great many other pests knocking for admission at the gates of Florida, any one of which could cripple some one of our horticultural industries or cause us an expensive eradication cam-

paign. The pineapple black weevil, which in Jamaica destroys 75% of the pineapple crop; the avocado weevil of Mexico and Central America; the cocoanut bud rot of the West Indies and Central America are but a few of many, too numerous for discussion at this time. We don't even know them all. Citrus canker was an unknown disease to science until it appeared in our groves. So there are others. Exploration by competent scientists is continually going on and the information gleaned by them from the byways of the world is made available by the bulletins of the U. S. D. A. To be forewarned is to be forearmed. Meantime specific quarantines will aid us and blanket quarantines will help. In order that the country will not suffer from the non-introduction of new and desirable varieties of fruits we have the Office of Foreign Seed and Plant Introduction at Washington. In all other cases an ounce of prevention is worth a pound of cure. Never again do we wish to say the familiar lines, "Of all sad words of tongue or pen, the saddest are these, 'It might not have been,'" but rather, in the words of C. L. Marlatt, chairman of the Federal Horticultural Board, let us adopt the philosophy, "The past can not be remedied, but the future can be safeguarded, and that is the present opportunity."

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Community Spraying and Compulsory Control

H. Louis Geiger, Miami, Florida.

Throughout the practice of horticulture, we find certain classes of insects, against which the individual wages as hopeless a battle as the youngster who builds a dam of sand to hold back the tides of the ocean, and it is only through the *combined* efforts of these individuals, that they are able to gain the mastery in the fight against insect enemies.

In citrus culture, we find this condition existing in our fight against certain species of white fly, scales, plant bugs, mites and red spiders, and it is only through the eternal vigilance of our State quarantine inspectors that we are not fighting such pests as the Mediterranean fruit fly, the black fly or black-winged white fly and other exceedingly injurious insects, which find their way to the very gateway of our State.

Individuals finding that their continued efforts fail to effect control of an injurious insect, which is general in their section and which is causing an ever-increasing drain upon their bank accounts, soon investigate the true cause of their failure and attempt to remedy it.

The cause is invariably the same. Lack of concerted action in all infested areas, with those methods by which maximum efficiency is achieved, and the natural solution of the trouble would appear to be the adoption of community spraying.

A few of our insect enemies are controlled by methods other than spraying, but as spraying is the most common form of protection used in Florida, we will assume that spraying is the method of control which will be used, but what is said about spraying is in general applicable to all of the other forms of control.

Theoretically, community endeavor is the only practical, democratic way of accomplishing the desired results; but in actual practice, community spraying invariably falls short of its aim. The degree of success or failure is in direct ratio (1) to the damage which the insect has caused, (2) the intelligence of all of the individuals concerned, (3) their inclination to finance certain expenses, (4) inability to take action against food plants other than citrus, and (5) the degree to which community spirit has become established.

The first step in community control, is to secure the agreement of every property holder within the defined area, to spray his own property according to certain accredited standards and at such times as may be determined upon. In some cases there will be groves which are abandoned, or which owners cannot afford to, or will not spray, and the other members must stand this expense, for

each and every food plant of the insect in that territory *must* be treated.

The next problem, will be that of maintaining an inspection, to see if the agreement, which must cover every phase of control, is carried out in detail.

The inspector must be a trained man, with considerable experience, and his service must either be paid by all of the individuals or some one must be found to do this work gratuitously. The inspector's salary, if paid, will in most cases, however, come from the pockets of a few progressive growers, the balance objecting to the additional expense. Few men are in a position where they can afford to devote the necessary time without some remuneration.

Last year I organized, supervised and inspected community spraying against cloudy winged white fly, and I know from experience how the work drags on and on; and that this is a thankless and very bothersome piece of work, that takes weeks of time one really cannot spare. Inspection, however, is absolutely necessary and without this community work would be positively valueless.

Among other things, the inspector will have to determine the correct time to start the spraying, and this may vary in different groves and localities. He must test the strength of and pass upon, the numerous spray solutions which the individuals will wish to use, and which may or may not be satisfactory. He must examine spray outfits and nozzles, keep watch of working pressures, see that the materials are at all times being properly applied in all of the groves in order that the highest degree of efficiency is obtained.

The failure of community work of this sort, lies in the fact that the inspector has no method of forcing the grower to spray on time; or of enforcing his recommendations, when they meet the opposition of refractory individuals, and of those who take but little interest in their own property and no real interest in the welfare of the community or the State. When tact, diplomacy, threats, and boycotts have failed, there is no way in keeping the laggards from undermining the good work of their neighbors.

For these reasons, *community spraying* will *fail* almost without *exception* wherever tried, but I do *not wish* it *understood* that these *sprayings* are *valueless*. In our experiment, which covered just *one spraying*, and in which we *did not get the co-operation* I expected, we *derived* sufficient *additional benefit* from the co-operation we did secure, to *prove* what *could have been done* if we had had the *proper legal power behind* us.

The only feasible method of control is through State legislation, compelling a community to control, by concerted action and under the direction of competent inspectors, all insects and diseases which cannot be controlled by individual endeavor.

There will be considerable opposition raised against legislation of this sort, by those who are ultra-conservative and unprogressive; but since the war with Germany started, the general public has come to take a different attitude toward State and Federal legislation. In my opinion,

they would realize that it is not a breach of their personal liberty to compel every *man* in a certain locality through proper legislation, to spray *his* grove in accordance with certain approved standards in order to control an infestation which affects him in common with his fellow men; or to take any other steps necessary to protect his own crops and those of his neighbors, when this is the only method by which such control can be gained.

It is comparable to legislation enforcing all forms of quarantines, fire laws, motoring laws, and the thousand and one things which society demands of the individual, for the good of all the people concerned.

Legislation of this sort, however, should not consider only compulsory spraying. The true goal is a broad and liberal law for community control. Spraying is only one of the forms of controlling insect pests in general. Natural enemies of the injurious insects are sometimes introduced; in some cases fungi are resorted to and at other times fumigation or dusting or handpicking would accomplish the greatest good.

The law, or measure, allowing for compulsory control should deal not only with insects, but should include also the diseases which menace the agricultural interests of the State.

The insects and diseases against which compulsory control would be necessary, would have to be decided upon by a board of investigators, who are trained entomologists and pathologists; and their decisions would naturally vary with different localities and prevailing conditions. Insects and diseases which menace the prosperity of one section, may be of little importance in another section; and those which we may not consider important today might become so after a few years. It is quite possible that some insects will decrease in importance as more natural enemies become established, and in due time could be dropped from the compulsory control list; while still other insects and diseases may be eradicated.

It seems to be the concensus of opinion that the following list presents the principal insects and diseases of citrus and some other plants which might be made subject to compulsory control, when and wherever necessary.

INSECTS AND DISEASES WHOLLY OR PARTLY ON CITRUS.

Common white fly, cloudy-winged white fly, wooly white fly, Florida red scale, purple scale, long scale, chaff scale, cottony cushion scale, plant bugs, rust mite and red spiders; withertip, scab, scaly bark, gummosis, foot rot and stem end rot.

MISCELLANEOUS INSECTS.

Green shield scale, San Jose scale, West Indian peach scale, sweet potato root weevil, Japanese wax scale, mining scale, Cuban citrus thrips and camphor thrips.

PECAN INSECTS AND DISEASES.

Fall web worm, twig girdler, pecan leaf casebearer, bud worm, pecan scab and pecan dieback.

ERADICABLE INSECTS AND DISEASES.

Citrus canker without question belongs under this heading. Cotton boll weevil and banana root borer; while some measure of control of these is possible, the proper remedy lies in eradication and eradication is possible in both cases.

I have not added to this list of insects and diseases any which may come under this heading in field or truck crops.

Compulsory control once obtained for insects and diseases, would put Florida on an agricultural basis unequaled by any state in the Union.

The advisory board would pass on the necessity of compulsory control and the State Plant Board, already organized and trained, would direct the work. In the event of individuals failing to comply with their orders, or who are unable to do the work, the State Plant Board would be obliged to do this work and charge the expense to the property and collect in liens, if necessary.

This would quickly eliminate the abandoned and neglected properties, which are a menace to us, as endemic centers of disease and insects, and by their neglected appearance greatly depreciate the value of surrounding properties. It would not only safeguard the present agricultural interests of the State, but would cause an influx of agriculturists who realize that the degree of control obtainable under such legislation against insects and diseases, would remove the greatest menaces to whatever crops they may wish to plant and that their chances for success are one hundred fold better in such a state than in one which allows nature to take its own course.

It is simply a question of whether or not the agricultural interests of this State have advanced to a plane where they are big enough to put this over.

We are coming to compulsory control as surely as night follows day, and the sooner this legislation is enacted, the better it will be for each and every person living within the boundaries of Florida, and if the members of this Society agree upon the necessity of compulsory control, I feel that we should work for legislation along these lines as soon as conditions point to the State being in a position to carry on this work and enforce such a law.

Quarantine Work of the State Plant Board

L. R. Warner, State Plant Board, Orlando, Florida.

I am sorry to have to appear before you twice the same day. I am sure you are missing a treat in not hearing Dr. Montgomery. The press of work was too heavy at Gainesville and he could not come down.

I want to tell you a little about our quarantine work. You, of course, want to know how you are being safe-guarded against pests. This is being done by the Quarantine Department. Our quarantine inspectors not only hold appointment under the State Plant Board, but also under the Federal Horticultural Board.

All imports into the United States come through the Treasury Department; all plants coming by parcel post come through the Postoffice Department.

The men in the Quarantine Department must neccessarily have a great many qualifications in order to hold the job down. Not only must they have scientific training in the work, but they must have a great amount of common sense, good judgment and tact. They must be able to make decisions instantly. There come up sometimes thirty-five decisions in the course of an hour or two. These men have been gotten from the ranks of the Nursery Inspection Department. The Nursery Inspection builds its force up from the canker eradication organization, so these men know every phase and every detail of field work.

I would like to tell you of a few instances of port routine. We have stations at Pensacola, Jacksonville, Tampa, Key West, West Palm Beach and Miami. We consider these the principal ports at which we should have men stationed. At Pensacola we are keeping out the sweet potato root weevil, citrus canker and brown rot. At Jacksonville the work is practically all railway work, on account of so many different railroads coming in there. At Tampa it is railroad and port. At Key West it is practically all foreign ships. We have about ten men known as assistant quarantine inspectors. Sometimes we have to have two and three at one port in order to handle the proposition. Every express train, when it pulls into the station, is boarded. The Union News agent is asked if he has any California citrus fruits or Gulf States citrus fruits; the passengers are watched as they walk out of the stations to see if they are carrying anything in their hands. The same applies to freight trains. We go through the freight trains every day at each of those stations, and the men walk through the empty freight cars. At Jacksonville in particular, where you can't see all the freight trains, on account of the

moving back and forth, they permit us to read through all the waybills, showing every class of freight that comes into the port. The same is true of the big steamers that come in there. We read through all their manifests every day.

In addition to inspecting railroads to intercept quarantined products, we also have the co-operation of the Postoffice Department. All mail shipments of plants and plant products coming into the State of Florida have to be sent to Pensacola, Jacksonville, Tampa, West Palm Beach or Gainesville, for inspection. A great many interceptions of dangerous material have been made. When first this work started, between 25% and 40% of the plant products coming by mail were found to be infested or infected.

The great problem is the foreign countries problem; 11,145 vessels have come to our ports since December, 1915. Of these, over 5,000 have come from foreign countries. That means that every time a ship from a foreign port arrives at one of our ports, our plant inspectors are on the dock. Everything of a quarantinable nature is put under seal, and if especially dangerous, is destroyed. In order to carry on quarantine work, the man has to have a good idea of the world in his head. A ship comes in; he understands it is from Brazil. Immediately he must think of the pests in Brazil, so that when he goes aboard, the moment his eye falls upon a plant, he thinks of the pests of which the plant is a host. If it is a fruit fly pest, that fruit must be destroyed. In my first talk I mentioned the fact that the maggots of the Mediterranean fruit fly lived seventeen weeks in salt water. If infested fruit is thrown out near the shore, and in the next seventeen weeks that fruit washes up on the shore, that pest could come out and infest out groves. We, therefore, not only do not allow fruit on ships from countries where Mediterranean fruit fly is established to be brought ashore, but arrange that the waste from such fruit as is consumed on board while the vessel is in port shall either be destroyed or carried far out to sea and dumped overboard.

I have a few statistics. From ships arriving from foreign ports and other places in three years, 36,283 shipments have been inspected, of which 28,450 were passed, 3,117 treated and passed, 1,367 were returned to the shipper, and 3,349 were destroyed.

During the same period the inspectors examined 20,283 shipments and parcels by freight or express on the railroads.

Of parcel post shipments since October, 1916, to March 31, 1919, there have been inspected 12,782 parcel post packages of plants addressed to Florida.

I would like to give you a few instances of important interceptions. You have heard of the black fly in Cuba and Jamaica. In January, 1918, a big cluster of grapefruit was found infested with the fly. Three weeks ago more black fly was stopped at Key West. The Gypsy moth from the northeastern states was intercepted. Citrus canker bud wood was once stopped by one of our port inspectors. The West Indian fruit fly has been stopped. Last August two boxes of rotten mangoes came in from Cuba. They were

destroyed and specimens sent to Gainesville. If these had been permitted delivery in any part of Florida, and the owner discovered that they were worthless, he would have thrown them out in the back yard, and by now we would have a big area infested by the West Indian fruit fly.

One of the principal food crops of Florida is the sweet potato crop. It is too late, perhaps, to save Southern Florida, as already twelve counties are heavily infested with the weevil. Baker county, in the northern end of the State, is also infested, but by a campaign of eradication that we are carrying on, we hope to save it. All of northern and western Florida, with the exception of Baker county, is as yet clean from the sweet potato root weevil. In the last six months infested sweet potatoes coming into West Florida at Pensacola, were intercepted. When one thinks that if this had been thrown overboard; if the colored cook or some other member of the crew had carried a supply home, and they had thrown them out in the back yard, it would not be long until the sweet potato industry of West Florida would be destroyed.

In conclusion, I want to say that, although there are a great many pests in Florida, we don't want any more, and from my three years' contact with agents of the State Plant Board, I wish to assure you that we will do everything in our power to prevent further infestation.

Does It Pay to Spray Citrus Trees?

G. D. Sloan, Lakeland, Florida.

The subject under discussion is one of utmost importance and one that deserves much broader discussion than I am able to give. There should be no argument of this question. The effects are so plain it does not seem possible to find any one that would say that it does not pay to spray citrus trees. However, it is a fact that we meet a large number of people, and some of them well posted on citrus culture, who will tell you it is not a paying operation. A short time ago I met a gentleman, and while in conversation with him, he said he did not believe in spraying; that it was a Yankee trick. It may be a Yankee trick, but the Yankee that originated it deserves a great deal of credit—a credit that most any Cracker would be glad to claim. Another gentleman said he had been growing citrus trees for ten years, and had never had a spraying machine in his grove, and always had good success with his crop. The third gentleman, who is manager of a large citrus grove, said that he did not believe in spraying, as it is not a paying proposition. Now the gentleman that has no spraying machine in his grove, probably knows all of the insects and diseases, but I have been in his grove a number of times, and have never seen a first class crop of real bright fruit harvested from his grove.

The second man stated that he controlled the white fly and scale with the red white fly fungus and the red-headed scale fungus and that he was never bothered with thrips and rust mite. If it were found possible to control white fly and scale with fungi the growers would save thousands of dollars annually by omitting spraying. This gentleman probably knows rust mites and thrips but he must have a wonderful grove if it is never infested by them.

These insects do more to spoil the appearance of the fruit and to cut the crop short than any other insects of which I know. I have never seen a full crop of real bright fruit marketed from the grove of which the third gentleman is manager. The prices obtained have always been low and the yield not up to the standard.

The fungi which attack white fly and scale are truly a great benefit to the citrus grower but it is rarely possible to control these insects sufficiently with fungi to prevent great damage being done by them. We have no known fungi which attack thrips and rust mite. They are easily controlled with a lime sulphur and nicotine solution. But this solution is also a fungicide. By its use the beneficial fungi are destroyed to a great extent. It is also necessary to use a fungicide in the control of citrus scab, withertip and

many other diseases caused by fungi, which makes the use of friendly fungi as the only preventative of white fly and scale not practicable.

Spraying is an expensive operation, as concerns first cost. It requires careful study to determine the proper time of application and the right material to be used. It likewise requires thoroughness in application to obtain results. It may be done at such time and in such manner as to be of no value whatsoever to the grower.

It is estimated by those who are in a position to know, that thrips when most plentiful cause a dropping of from 50% to 75% of the fruit and at least 20% under less favorable conditions. It is also estimated that bad infestations of white fly and scale diminish the size of the fruit 20% to 25%, and greatly reduce the vitality of the tree. Rust mite causes fruit that is perfect in every other respect, to be placed in the second and third grades. The second grade brings from 50 to 75 cents per box less than the first.

I have record of a fourteen-acre orange grove of very fine trees. Spraying for thrips and rust mite was omitted two years ago, although a vigorous campaign was waged against the white fly and scale which practically cleaned the grove of them. Three thousand eight hundred and seventy-two boxes of oranges which brought a net price of $4,550.00 was gathered from this grove. The fruit, while of good size and free from sooty mold, were very rusty. It was estimated by this grower that he had lost, at least, 50 cents per box, or $1,936.00, by not spraying for rust mite. Supposing that he lost 20% of his crop by thrips, and a 10% loss could have been prevented by spraying (and I am sure he lost far more, as I was in the grove shortly after the petals had fallen). A total of 484 boxes at a net price of $1.18 per box, or $571.12, would have been saved. Taking the amount lost from rust mite and thrips, we have a total of $2,507.12 loss which might have been prevented by spraying three additional times.

The following year this grove was sprayed five times as follows:

March 6th to 8th—lime sulphur and nicotine.

May 12th to 14th—miscible oil and soluble sulphur.

June 12th to 15th—lime sulphur.

October 10th to 13th—oil emulsion and soluble sulphur.

December 18th to 21st—lime sulphur.

The total cost of the five operations were as follows:

March—	
110 gal. lime sulphur at 30c	$ 33.00
55 gal. Black Leaf 40 at $1.25	68.75
Labor—use of machine	64.75
Total cost of operation	$166.50
May—	
73 1-3 gal. insecticide at 50c	$ 36.65
176 gal. soluble sulphur at 12½c.	22.00
Labor—use of machine, etc.	73.50
Total cost of operation	$132.15

June—
88 gal. lime sulphur at 30c. ----$ 26.40
Labor—use of machine, etc. ---- 63.75

Total cost of operation ------$ 90.15

October—
76 gal. insecticide at 50c. ------$ 38.00
178 gal. soluble sulphur at 12½c. 22.25
Labor—use of machine, etc. ---- 74.25

Total cost of operation ------$134.50

December—
115 gal. sulphur at 30c. --------$ 34.50
Labor—use of machine, etc. ---- 64.50

Total cost of operation ------$ 99.00

The entire cost of the five sprayings amounted to $622.30 and if you do not believe the spraying paid, listen to the following figures.

The result was that more than 6,084 boxes of fruit were gathered which graded as follows:

Four thousand and thirty boxes No. 1, 1,842 boxes No. 2, 212 boxes No. 3, and culls.

The fruit sold for $2.00 a box on the tree, or $12,168.00, an increase of $7,-618.00 over the previous year.

True, all of this increase cannot be credited to spraying, but spraying did more to produce this increased value than did any other single operation in the grove.

When estimating the cost of spraying we cannot take the cost of one year alone. Again, the spraying of bearing grapefruit trees is, as a rule, much more expensive than spraying orange trees of the same age, for the reason that we must make several sprayings on grapefruit to prevent citrus scab, which is not necessary on orange trees. The spraying is much more expensive in some years than in others, depending upon weather conditions and the severity of the insects and diseases.

The following are accurate figures of the cost of spraying different groves of different ages from one to five years. These figures are from first-hand information and the actual cost of operation, including all labor, material, and wear and tear of spraying machines are charged. Five different groves of ten acres each, from one to five years old were used as examples and all applications necessary were given them. Water was hauled by team, approximately one-half mile to each grove.

FIRST YEAR—GRAPEFRUIT.

Citrus Scab—February:
2½ gal. lime sulphur at 30c.----$ .75
Labor ---------- 3.50

$ 4.25

Citrus Scab—March:
2½ gal. lime sulphur at 30c. -----$ .75
Labor ---------- 3.50

$ 4.25

Citrus Scab—June:
2 gal. lime sulphur at 30c. ------$ .60
Labor ---------- 3.50

$ 4.10

Citrus Scab—September:

3 gal. lime sulphur at 30c.	$ .90
Labor	3.50
	$ 4.40

Scale—November:

2 gal. insecticide at 50c.	$ 1.00
Labor	3.50
	$ 4.50
Total cost for first year	$21.50

SECOND YEAR—ORANGES.

Scale—November:

7 gal. insecticide at 50c.	$ 3.50
Labor	5.25
Total cost for second year	$ 8.75

THIRD YEAR—GRAPEFRUIT.

Citrus Scab—February:

15 gal. lime sulphur at 30c.	$ 4.50
Labor	7.00
	$11.50

Citrus Scab and 6 Spotted Mites—March:

15 gal. lime sulphur at 30c.	$ 4.50
7½ gal. Black Leaf 40 at $1.25	9.38
Labor	7.50
	$21.38

Citrus Scab—June:

12 gal. lime sulphur at 30c.	$ 3.60
Labor	7.00
	$10.60

No scab apparent at later date.

Scale and White Fly—November:

10 gal. insecticide at 50c.	$ 5.00
Labor	7.00
	$12.00
Total cost of operation for third year	$55.48

FOURTH YEAR—ORANGES.

Scale and White Fly, 6 Spotted Mites—May:

14 gal. insecticide at 50c.	$ 7.00
Labor	10.50
	$17.50

Scale and White Fly—November:

14 gal. insecticides at 50c.	$ 7.00
Labor	11.25
	$18.25
Total cost for fourth year	$35.75

FIFTH YEAR—GRAPEFRUIT.

No scab apparent.

Scale and White Fly and 6 Spotted Mites:—May:

16 gal. insecticide at 50c.	$ 8.00
Labor	17.50
	$25.50

November:

17 gal. insecticide at 50c.	$ 8.50
Labor	18.00
Total cost for year	$26.50

Two hundred and forty-six boxes fruit were picked from one grove, which netted $1.60 per box, or $393.60. To have sprayed three additional times for thrips

and rust mite, according to previous estimate, would have produced 270 boxes at about $2.10 per box net, or an increase of approximately $173.40. The three additional sprayings would have cost $120.50, leaving a gain of $52.90.

It is, therefore, apparent from the cost figures that spraying for bright fruit pays, even though we have a very light crop.

While spraying for better fruit, we should bear in mind the number of fungous diseases we are preventing from becoming established in our trees. Such diseases as stem-end rot, anthracnose, tear-staining and many others of more or less importance are prevented by our method of spraying, as just discussed.

When every grower realizes the importance of proper spraying we will see far healthier trees, better fruit, more of it, and a better price per box.

Question: Mr. Chairman, I would like to ask the gentleman a question. When would you spray for white fly this spring?

Mr. Sloan: That would depend upon conditions. Usually in May—from the 15th of May to the 1st of June.

Mr. ————: I notice in a bulletin from the Experiment Station at Gainesville, written by J. R. Watson, that he says spray from two to three weeks after the fly has disappeared, unless the oranges are not an inch in diameter. If your oranges are not fully one inch in diameter, wait. If Mr. Watson is here he might tell us something about it.

Prof. Watson: You gave me too much credit for that. That schedule was the joint work of all the pathologists and entomologists in the State. The idea is that the fruit ought not to be too small when sprayed. We do not advise putting on oil sprays if the fruit is too small. You may not do any harm, but in giving you advice of that kind, we want to be as safe as possible. I suppose if it is dry and the fruit grows more slowly, it need not be necessary to wait so long perhaps. It depends upon the age of the fruit perhaps as much as the size.

Mr. ————: Some of my fruit are almost an inch in diameter, but most run from very small up to this size (indicating), and the fly has disappeared probably three weeks ago. Would you spray right now or very soon?

Mr. Sloan: I would spray during the month of May.

Mr. ————: And it does not matter whether it is done this week, or the next week, or the week after?

Mr. Sloan: You want to get the white fly in just the right place. If you get it too far in advance, or if you get it too long after the white fly has disappeared, your spray will be lost.

Mr. ————: Does it pay to spray, using lime sulphur with oil emulsion?

Mr. Sloan: I never found it best. I always use the soluble sulphur. It is not as strong as the lime sulphur, but I have always gotten results.

Future Protection Against Citrus Canker

Wilmon Newell, State Plant Commissioner, Gainesville, Fla.

I have talked about citrus canker so much and so many times, and for the last month I have talked citrus canker to the members of the Legislature at Tallahassee, until I talk about it in my sleep. The telegram that has just been read makes me feel like talking somewhat differently from what I had intended, but I am going to say tonight many things that I have said to many of you many times before, and it is perhaps fortunate for me that the territory adjacent to Orlando produces oranges instead of cabbages. Oranges are now too valuable to throw at a speaker. But I think that I am going to keep on talking along some of these lines until citrus canker has become a thing of the past in Florida, (applause) and it is my feeling right now that we are going to keep on talking that way, and that we are going to get rid of citrus canker, whether the State Legislature of this State wants to have it that way or not. (Great applause.)

The present situation is a critical one. I would have considered it critical had the appropriation bill passed for its full amount, viz: $130,000.00 for the canker eradication work for the next two years. Even with abundant resources available for this work, the situation would still be critical. You may be surprised at that statement, for doubtless many of you think that the war against canker in Florida is over. My friends, it is not over, any more than that war in Europe was over when the Germans first began to run. Citrus canker has, so to speak, a number of machine gun nests hidden around in the groves in Florida. We know pretty well where they are, but they have got to be cleaned out before this campaign can be considered finished. We do not propose to sign any armistice with citrus canker. This must be a war of complete annihilation, just as I believe the German Empire should have been annihilated over yonder before the work was stopped.

Before going any further, I think it appropriate that we should try to give you some idea of what has been done in the fight against citrus canker. As to the rate at which the disease has been decreased (and that is the most striking thing about it), I would refer you to this chart here, which shows the number of canker infected trees found in the State each month since the canker eradication work was commenced in May, 1914, by the Florida Growers' and Shippers' League. We have exhibited a chart of this kind many times before Florida fruit growers, and my only excuse for bringing

it here is that it has been brought up to date. For example, there were found in May, 1915, 1,042 trees; in May, 1916, 338; in the same month in 1917, 52; in the same month in 1918, 1; whereas in 1915 and 1916 we were finding several thousand trees a year infected with the disease, that number fell to 15 infected trees during the entire year of 1918, and only two infected trees have been found in the four months ending May 1st of this year. Probably that chart looks pretty good to you. One trouble about it is that it looks entirely too good, and that is one thing that is the matter at Tallahassee. There are a number at Tallahassee that say canker is not doing any damage. Why spend thousands of dollars on this work, when you have only found two canker infected trees in four months in the State of Florida?

Refer to this other chart, and for the time being dismiss from your minds all ideas of trees, because this chart does not deal with trees at all, but deals with canker infected *properties* which we have had in the State of Florida. On this chart each space in a horizontal direction represents one month; each space in a vertical direction represents fifty properties. The red line shows the total number of canker infected properties found in the State up to the end of any given month indicated on the chart. For example, at this point, the end of February, 1915, 250 canker infected properties had been found up to that time. On the 1st of April, 1919, the total number of canker infected properties found in the State was 480. You will notice that during 1915 and 1916 this line (indicating) rose very rapidly—the number of canker infected properties was increasing—but that from the middle of 1917 to the present time the line has risen very little, and in the last six months it has hardly risen at all. In other words, the increase in the number of infected properties has been very slow for practically the last two years. Of course that line can never come down, for the reason that it is a cumulative line. It represents the total number of properties in which the disease has been found up to a given date. The green line starting at this point (indicating) represents the number of properties infected with Canker which, up to the end of any given month, had been declared no longer "danger centers" by the Plant Board. When the Plant Board makes that declaration it is merely an expression of opinion, and by declaring it no longer a danger center, the Board removes the quarantine restrictions in the zone around it, thus allowing the planting of citrus trees around it; but by that action the quarantine is not entirely removed in the property itself, for the reason that a degree of danger does still exist there, and certain precautions are required. You will notice that this line (indicating) also has been rising and approaching the other one. At this point (indicating) the 1st day of April of this year, it represents 475 of those canker infected properties which have been declared no longer danger centers. Stated in another way, the quarantine had been partially removed from the 475. That left us five properties in the State still classed as actively infected. That is rep-

resented by the distance between these two lines. (Indicating.) By "actively infected" we mean a property in which the danger of citrus canker is so great that we expect to find an outbreak of the disease in that property at any time. I might explain that if this line were continued to the 1st day of May, the distance between those two lines would be a little greater than it is now, for the reason that one newly infected property was found during the month of April, so the total number of canker infected properties found in the State was 481, of which 475 have been declared no longer danger centers.

This line represents the properties which the Plant Board has declared "clean." When the Plant Board declares an infected property to be "clean," that is a declaration to the effect that in the judgment of the Board, eradication of the disease in that property has been made complete, and finally that a future outbreak, on account of that property, may not be feared. In other words, that property is put back into the same status, so far as quarantine is concerned, as it occupied before canker was ever found in it. The owner is permitted to re-plant citrus in it, and it is considered absolutely safe. We have in that class, to the present time, 292 properties. In other words, summarizing the situation, there have been 481 properties, all told, in which canker has been found. Eradication is complete in 292 of them. In 183 there is still an element of danger, and a partial quarantine is being kept on them. There are also still six properties which are actively infected. You may ask why we consider the 183 properties between these two lines, as dangerous. Past experience. No body of men is absolutely infallible, especially when dealing with an infectious disease, and by past experience we have found that even though the Plant Board and its employees use the best information at their command, they did make some mistakes in declaring properties no longer danger centers. They made that declaration too soon, and the actual figures show that of that class of properties 2% have subsequently shown citrus canker. We don't know which 2% will yet show infection. The only way we can find out is to watch them. The only way we can watch them is to inspect them, and we have got to inspect all of them in order to catch that 2% when it does develop.

I think you will be interested in some statements regarding the magnitude of the work that has been done, now when you see the situation as it exists, and I believe that that chart does truly represent the citrus canker situation. It is certainly an exact statement of the situation in so far as our available knowledge goes. Let us take, for example, these properties that are actively infected—so dangerous that we expect to find canker in them any time. It so happens that they are all properties in which the trees are very large, from five to fifteen to twenty years of age. In those properties there are 4,000 bearing trees. They must be inspected once a week. In trees of that size the inspection is a very slow matter. It must be close enough to detect canker infections no

larger than a pin head. It also happens that those six canker infected properties are located in neighborhoods where large groves of large trees are packed in closely around them. Within a mile, and, for the sake of this discussion, we can consider a mile a dangerous distance, there are over 160,000 bearing trees, and those trees are all over five years old, and some perhaps twenty-five years old. Those properties have a degree of danger so great that we know they must be inspected once a month.

I have outlined for you the inspection work in extremely dangerous territory, that is costing about $7,000.00 a month. We have got to do that kind of inspecting; we have got to inspect those dangerous properties that are around those properties that have had canker recently. That was the way this newly infected property was found last month. That property had never shown canker before, and if we had not been making the inspections there, perhaps it would have spread for many months to come, and perhaps wiped out many groves before gotten under control.

Here are 183 properties, of which we know, from past experience, that approximately 2% will develop canker, sooner or later. They are on a monthly inspection, which is just as light an inspection as we can give them with safety. Some of those properties are certain to develop canker. The properties around each of those is also dangerous and must have an inspection about once in every three or four months.

I believe that eradication is absolutely final in these 292 properties, but we may be mistaken, and on the chance that we may be mistaken, we are inspecting those once in six months.

I have not said anything about looking around for any other signs of infection that might be hidden away in the State somewhere. It has taken us four years to make one hasty inspection of the citrus growing area in Florida. We ought not to be content with that, or to be convinced that there is no more citrus canker hidden away somewhere, until we have gone over it two or three times. I have outlined very briefly the inspection phase of the canker eradication work, and have tried to show you why this amount of inspection is necessary. What does it cost? $15,463.00 a month. That was the average cost for the last two months, of which the Government paid $5,000.00 each month. The rest was paid out of State funds. In the face of all that inspection work being required to checkmate any new infections, the Legislative Investigating Committee recommended to the State Legislature that the majority of the citrus canker inspectors be "discharged immediately." The Plant Board has tried to be economical—it has been economical. It has decreased the inspection force and the monthly expenditures on this work just as rapidly as it felt could be done with safety. For example, in September, 1916, we had 418 employees on this work. That force has been reduced until today we have 103. The monthly cost of this work in 1916 was over $35,000.00 a month. Now it is approximately $15,000.00. What does

it mean if this work does not go on to completion? In the first place, it would mean the loss of all the efforts and money and sacrifice that has gone into this work so far. Up to this time $1,159,000.00 is the cost of canker eradication in Florida. Of that sum the citrus growers furnished $99,000.00, the State furnished $310,000.00 and the United States Government put up $750,000.00. All of that money will be wasted if this work is not completed. Citrus growers have given up voluntarily, for destruction, trees before they showed the disease. The growers' personal sacrifices have aggregated one million or one and a half million dollars. Unless this work is completed—carried to its logical conclusion—it simply means that the disease will get started again, and when it does get started it is going to take a great deal more money to get it by the throat again than it has done this time. Here is just one phase of it. Suppose we stop this canker eradication work now. The employees we have, who have had four years of experience in dealing with these conditions, and who know the citrus canker better than anyone else, must seek further employment. There is not a man that can't get a better paying job tomorrow than he has got now. When canker gets in the State again we will not be able to get their services. How will we get new inspectors? The only way you can train a canker inspector is to train him with citrus canker, and we will have to let the disease grow and spread in the State until we can find a man and take him out and show it to him every day, until we can train him to be an efficient inspector. The $130,000.00 that was asked for in that appropriation bill would not have been enough money to complete this work during the next two years. We were banking absolutely upon that amount of money being supplemented by an appropriation by Congress, when the latter meets in the near future, but the U. S. Government is not likely to supplement our appropriation by any greater amount than the State has appropriated. That leaves us in sight, according to the information which arrived tonight, only $100,000.00 for the next two years. If we have good fortune, we may be able to devise some way of squeezing through, but I doubt it very much. I have serious doubt whether, with those limited resources in sight, we can finish the eradication of citrus canker in this State. The outlook certainly is a very serious one, but, regardless of that phase of it, I do know this: that this is a time when you, as growers, have got to put your shoulders to the wheel. I don't mean necessarily financially—we may have to ask you to dig for the wherewithal to help us out—but we want every last one of you to realize the gravity of the situation, and to realize that you, in your grove and in your community and in your county, can do a bit—and a very important bit—towards making the citrus industry of Florida safe from canker. What do I mean? I mean this: that if the growers of Florida had been doing for the last three years the things that we were asking them to do, canker would be gone from Florida today, and the situation would not worry us one particle. If every grower

in the State of Florida had made it a rule not to let a laborer come into his grove without finding out where that laborer came from; if every spraying machine and every lot of picking equipment had been disinfected before it went into a grove, we would be rid of canker today, and the lack of precaution on the part of the grower has kept it going on. This newly infected property found in Largo this last month never had canker in it before. It is possible that that canker was brought there by a bird, but we also found out that the owner of that grove last December went to his neighbor's place, and his neighbor's place had had citrus canker a few months ago, and last December he put the neighbor's spraying machine on a pair of skids and took it home to his barn —drew it through his grove. This citrus canker that was found in his property was on a leaf partially buried in the sand, lying along the trail where that spraying machine was hauled in December. We have had dozens upon dozens of cases like that—cases where men took the risk, because in *their* opinions, it was safe, when we told them it was not safe. What did they do? They scattered canker right and left, and sooner or later we would have a dozen groves infected with canker to clean up, whereas if they had taken these precautions, there would have been perhaps one or two. From now on we have got to have your co-operation more that we have ever had before. If not, citrus canker is going to be a bigger menace to your industry than it was in 1915. We know there was the movement of nursery stock that was not properly safeguarded, and in many cases, moved in violation of the law. Now we have an efficient nursery inspection system, and I think we will be able to keep it going. When we go back over the history of these canker infections, when we go back over the history of cottony cushion scale, scaly bark, etc., we find that the great majority of those infections were due to the movement of nursery stock not properly inspected and certified. Under the conditions for the next two years, every movement of uncertified nursery stock will be a great danger. You may see a man going along the road with a few citrus trees and you may think, "It is none of my business." If those are not certified, they may be as dangerous to your grove as a man coming towards your house or barn with a fire brand. You don't know what they may be carrying, and if you are going to protect your industry, you must now comply with these regulations and get a compliance of them much more firm than we have ever had before. You must remember this. The distribution of canker infected trees from one canker infected nursery in Florida can undo, in sixty days, everything that has been done, at the expenditure of over a million dollars, in eradicating canker. Don't encourage unnecessary visiting and traveling through your groves. Keep visitors out of the groves. Don't let them in there unless they have business in there and a good reason for coming in there, and find out where they have come from and where they have been. Keep out wandering stock. With this money that is in sight, we of the Plant Board are not go-

ing to be able to know where canker is in Florida and where it isn't. Keep out trespassers. Don't have a driveway going into your grove or through your grove that is open to the public, and where the trees are so close to the road that the automobile tops brush against them. Did it ever occur to you that where a man who has occasion to come into your citrus grove with his car, he is engaged in a business that makes it necessary for him to go into other citrus groves? I could tell you of a great many of those things, each not a great thing in itself perhaps, but all of them together contributing a great measure of safety, or danger, as the case may be, to our industry.

Before I go further I want to say that the situation we are in now is one that is almost an exact parallel to a little experience the State of Massachusetts had with the Gypsy moth a few years ago. That pest first appeared in the latter part of the 60's, brought over by some fool who thought he could cross it with the American silk worm, and get a very profitable silk worm in the United States. At that time the State entomologist of Massachusetts went to the State Legislature and told them it was an extremely dangerous thing. He told them they could eradicate it at a cost of $5,000.00. They paid no attention to him. It became so serious that the State Legislature later made an appropriation of $1,175,000.00, for fighting that pest, and by 1900 the inspectors had reduced the Gypsy moth to the point where no one ever saw one. They went to the Legislature and said, "It is nearly eradicated. Complete eradication is in sight, and for about $150,000.00 more, over a period of ten years, we can finish the job." The Legislature said, "You fellows are just trying to keep your jobs going." The Legislature didn't appropriate any money. That was in 1900. By 1905 the pest had regained the territory and more besides. Then the Massachusetts Legislature woke up for the third time, and since that time have been spending one million dollars a year on that bug. It is still spreading. It is killing more and more forest trees and fruit trees. They find now that they couldn't eradicate it if they appropriated a billion dollars. Massachusetts lost her chance when she refused to appropriate the money "to finish the job." I don't need to make any comparisons. Just now, with this information from Tallahassee, we are not able to make many predictions as to what the course of the Plant Board will be during the next few months. The Plant Board will do the best it can under the circumstances. The most extreme and rigid economy of Plant Board funds is going to be absolutely necessary. There are just three things in Florida, so far as the Plant Board is concerned, that cannot be stopped. Those are citrus canker eradication, nursery inspection work and plant quarantine work. You know well the reasons for those three things, and everything else has got to be subjugated to those three. I am afraid the Plant Board will have to turn the cottony cushion scale loose and let it go.

In like manner we have been trying to hold back the sweet potato weevil, a pest that is costing us $400,000.00 a year now.

I fear we have got to let that spread. I want to tell you this, right on that line. Last year we found three sweet potato growers growing infested sweet potato plants, preparing to ship them all over the State of Florida. He stopped them from making those shipments. When we quit that line of work, which seems we must do now, it means that your neighbor or somebody else is likely to get the sweet potato weevil on their place at any time, and when they get it there, it will only be a matter of two or three years before you will quit growing sweet potatoes.

All we can say, summing this situation up, is that the outlook is anything but bright. We have got to have your active co-operation in all of the precautions that we can conceive of, to prevent the spreading of citrus canker. I am not speaking alone of the places where we have had canker, but all the places where canker *might* be, and that is wherever a citrus tree grows.

I thank you for the very indulgent consideration which you have given me.

Co-operation Between the Nursery Inspection Department and Grove Owners

F. M. O'Byrne, State Nursery Inspector, Gainesville, Florida.

The Florida Plant Act of 1915, under which the Nursery Inspection Department of the State Plant Board is operating, was passed largely through the efforts of the horticulturists of the State. For this reason, if no other, the Nursery Inspection Department should look to the horticulturists for suggestions, advice and support.

In case the Nursery Inspection Department should fail to function properly, the horticulturists would be more directly and severely injured than probably any other group. The contractor, banker, merchant and lawyer are all injured indirectly by insect pests and diseases which cause loss to the horticulturist, but the direct and far greater loss is sustained by the grower himself. Even the nurseryman has a much smaller investment at stake than the growers. An individual tree in a nursery does not as a rule represent an investment of over half a dollar. A tree in a grove often represents an investment of ten dollars, sometimes more.

For these reasons criticisms and suggestions are particularly welcome when coming from the growers of the State. It is the object of this department to give the growers adequate protection. If there are points that we are overlooking, we are only too glad to have them called to our attention. Likewise, from the nature of the case, the growers can be of greater assistance to the Nursery Inspection Department than any other class. They come in contact with those who are growing small amounts of nursery stock more often than any others.

The various rules of the Nursery Department have been adopted after careful consideration. There is a good reason for each one. If the purpose of any of them is not clear, we are always glad to explain. If the growers are to receive adequate protection, the rules must be observed. You can help.

If you will think of it for a moment you will realize that it is a tremendous task to locate all the small nurseries in all of the little out of the way places in the State. Of course the law requires that all of those who are growing nursery stock shall apply for inspection at least sixty days before they want to move their stock. But many of those men in remote sections don't even know about the inspection law, much less the sixty-day requirement. They think they can grow stock and sell it locally without inspection.

You can help us by asking such men who have small batches of nursery stock whether it has been inspected yet. If it hasn't been, tell them to write the Plant Board for inspection, which is free, and then for fear they won't do it, write us a card yourself. Don't take the position that it is none of your business, because it is. It is for your protection.

See that the law is observed in your community. See that there is a tag attached to every bundle of nursery stock coming under your observation. The law requires it. If stock has no tag attached it is being illegally moved and therefore is dangerous. If a man spoken to does not take steps to comply with the law, report the matter to us.

When a deliberate and wilful violation of the law occurs in your community, let the proper official in your section understand that your interests demand that the offender be prosecuted. In many cases the prosceuting attorney is not a grower himself and often does not appreciate the necessity of seeing that the inspection law is complied with. If he knows that your interests demand that the law be enforced, he may feel differently about it.

Co-operate by complying with the law carefully yourself. Some growers who believe thoroughly in the strict enforcement of the law violate its requirements unintentionally themselves. Two examples will illustrate. An inspector once found a strong supporter of the Plant Board moving some uninspected and uncovered grove trees down the public road to another piece of his property, and told him that this was contrary to law. The grower thought this application of the law unreasonable at first. It was pointed out to him that persons passing would see him so moving untagged, uncovered trees, would not understand that he was moving them to his own property, and would think they could move trees in a similar fashion. Thus by precept he might lead others to violate the law. Then he understood. By letting down the fence, he was able to take the trees to the same piece of property by private road, traversing his own property all the way. That was all in accord with the law and was not in any danger of being misconstrued.

A man who is considered almost radical in his insistence that the nursery law be observed, was talking with me one day when I mentioned a violation of the law in which a nurseryman had secured a great deal of uninspected budwood. A puzzled look passed over his face and he said, "Say, does the law require that budwood be inspected?" I replied affirmatively and explained in detail that budwood was nursery stock and had to be inspected and certified exactly as any other stock. In explanation I pointed out that budwood could carry both insects and diseases exactly as any other nursery stock could, and backed up my statement by citing a number of instances in which it had done so.

"Oh yes," he said, "now that I think of it I can see that our law would be a farce if it didn't require the inspection of budwood. But I don't believe that that point is as generally understood as it should be. I have violated the law a number of times

myself, but rest assured that I never will again. You see, in a large grove such as this, there are a number of exceptionally good trees of several of the varieties, and neighbors would come to me frequently asking if they could have some budwood off this Pineapple or that Valencia. If they only wanted a few I would say, 'Sure, go ahead and help yourself,' but hereafter I will say, 'No, not till I have had that tree inspected and have some certificate tags for it.' "

The indiscriminate, illegal movement of budwood is one of the greatest dangers our horticultural industry faces today. There is no way in which insects and diseases can be more widely or quickly disseminated. Canker has been carried into innumerable groves and nurseries on budwood illegally moved. One man lost every citrus tree on his place and caused his neighbors even a greater loss in addition, because he cut budwood from an uninspected grove tree that he considered healthy. No man would cut budwood from a tree unless he believed it to be free from disease, but experience has demonstrated that a grower may consider a tree in perfect condition when in reality it is in the incipient stages of a dangerous disease.

The co-operation of the grove owners will enable us to almost completely eliminate this menace to their interests. Refuse absolutely to give away or receive uninspected budwood. We ask your co-operation in this regard for your protection.

There have been many requests for a condensed resume of the nursery inspection laws by those who do not care to read the law and rules in full. We have prepared such a condensed statement and I have here multigraphed copies I would be glad to give anyone, or they can be obtained at the door.

Conference on Spraying Schedules

Led by Mr. W. W. Yothers and Mr. J. R. Winston.

Mr. Yothers: The main object that I have in appearing here is to correct an erroneous impression that the committee which formed this spray schedule, advises ten sprayings per year on citrus trees. I certainly am unable to understand how anybody could get that impression. Furthermore, I don't think that the schedule has anything to do with any proposed law in regard to compulsory spraying. Spray schedules are based either upon the biology of the insect or upon the nature of the disease. We do not go to our laboratories and sit down and write spray schedules. First, the life histories have to be worked out, and then we make tentative spray schedules, and these are tried out year after year, until we find them either satisfactory or unsatisfactory. The present schedule is of some value at least, in showing that all of the entomologists and pathologists in the State are working in harmony to unify the work of spraying, to make it less confusing to the grower. It also shows the materials that can be used at certain times, and the objects of the application of these materials. It seems to me that those two points are perhaps the only infallible ones in regard to a spray schedule. All other phases of it might be subject to differences of opinion or dispute.

Mr. Winston and I have decided to take the spray schedule up and discuss it in detail, chronologically. That is, we will present that part of the schedule that should be used at the present time. According to my ideas, last week, or some few days last week, and this week and next week is the opportune time to spray for the ctirus white fly and for scale insects, both in this community and as far north as Crescent City, and as far south as Ft. Myers. It takes in nearly the entire State.

Turn to number 7 on your schedules. In May, when the fruit is one inch in diameter is the proper time to spray in order to kill the insect at the most tender stage; consequently I put in the schedule "fruit one inch in diameter." I suppose it would be about as satisfactory if I had said fruit one-half to one inch in diameter, because fruit, when it has attained the diameter of one-half inch, is not very easily injured by the spray material. Then, according to my experiments, the oil emulsion is a very poor spray for rust mites. In fact it is very unreliable for rust mites. It will kill a great many rust mites, but is very unsatisfactory and unreliable. But if you add the dry soda sulphur, or what is usually known as soluble sulphur, my experience is that it is very

satisfactory for the control of mites. This combination spray then would control white fly, scale insects and rust mites. It would make a very good combination for these pests.

There would be no trouble from rust mites for perhaps a month, or until the regular or main rust mite spray is given, which is No. 8, in June. I realize that the critical time to spray for rust mites varies from year to year, and also in different parts of the State. Perhaps the greatest variation is the difference between grapefruit and oranges. I have always found that the rust mite gets on grapefruit about a month, or nearly a month before it does upon oranges. Of course that would necessitate reaching back perhaps to No. 6 on the spray schedule. If you are growing grapefruit in Pinellas county or near Ft. Myers, and you expect to have bright fruit, it is necessary that you spray some time in April. After June the rust mite infestation ordinarily becomes less. June is pre-eminently the rust mite month. In July the rains come, and usually in a very few days after the rainy season sets in the rust mites gradually disappear. I remember last year in late July, August and September, and even as late as October, especially in October, it was almost impossible to find a rust mite around in this section. Then, as a consequence, it is not necessary, at least I don't consider it necessary, to spray during the rainy season for bright fruit.

That brings us to No. 9, which is also

A SPRAY SCHEDULE FOR CITRUS

The following spraying schedule is the result of a conference held at Orlando, Florida, February 27, 1919, participated in by H. R. Fulton, J. R. Winston, and J. J. Bowman, pathologists, and W. W. Yothers, entomologist, U. S. Department of Agriculture; H. E. Stevens, pathologist, and J. R. Watson, entomologist, Florida Experiment Station; and E. W. Berger, entomologist, State Plant Board.

This combined schedule is based on the work to date of state and federal investigators and represents their composite judgment regarding the control of citrus insects and diseases by spraying. Nos. 3, 4, 7, 8 and 9 are recommended as sufficient for the control of the enemies usually destructive on grapefruit in an average season, provided the spraying is done thoroughly. Oranges will usually only require three applications—Nos. 7, 8 and 9. Under conditions unusually favorable for disease or insect increase certain or all of the remaining applications will be required in addition.

Be cautious about using lime-sulphur solution when the temperature is above 90°. If used under this condition, use the weaker strength and be sure of the accuracy of the Baume test and the diluting.

The Bordeaux mixture requires 3 pounds of bluestone and 3 pounds of first grade quick lime in 50 gallons of water. Never use air slaked lime. If hydrated lime or inferior grade of quick lime must be used make it 4 pounds.

No.	Citrus Fruit.	Time of Application.	Material	Enemy.	Remarks:
1.	*Grapefruit	Just before first flush.	Bordeaux mixture 3-3-50.	Scab.	To be applied if scab is abundant on old leaves. When Bordeaux mixture is used it must be followed by two of the specified lime-sulphur applications within two months to reduce scale.
2.	*Grapefruit	Just before petals open.	Lime-sulphur solution 32° Baume; 2½ gals. in 100 gallons.	Scab. Rust mites. Red spiders.	To be applied if scab infections appear on new growth, or if rainy weather favorable for scab follows first application.
3.	*Grapefruit †Orange.	When one-third to one-half the petals are off.	Lime-sulphur solution 2½ in 100 gals. plus Nicotine sulphate 13 oz. in 100 gal.	Scab. Thrips. Rust Mites. Red spiders.	Add the nicotine if 25 or more thrips per bloom are present.
4.	*Grapefruit	7 to 10 days after third application.	Lime-sulphur solution 2½ gals. in 100 gals.	Scab. Thrips. Rust mites. Red spiders.	
5.	*Grapefruit	7 to 10 days after fourth application.	Lime-sulphur solution 2½ gals. in 100 gals.	Scab. Rust mites. Scale. Crawlers.	To be given if rainy weather favorable for scab infection follows fourth application.
6.	Grapefruit	April 5 to 15.	Lime-sulphur solution 2 gals. in 100 to 1½ gals. in 100.	Rust mites. Tearstain.	If any two out of Nos. 3, 4, and 5 have been given, this can be omitted; otherwise this is the critical spraying for rust mites on grapefruit.
7.	Grapefruit Orange.	In May when fruit is at least 1 in. in diameter.	Oil emulsion 1% plus dry soda sulphur 2½ lbs. in 100 gals.	White fly. Scale insects. Rust mites.	The oil emulsion should be used so that the diluted spray material should contain 1% of oil, i. e., if the emulsion contains 66% of oil, 1½ gallons would be required for 100 gallons of water.
8.	Grapefruit. Orange.	In June.	Lime-sulphur solution 2 gals. in 100 to 1½ gals. in 100.	Rust mites. Tearstain.	On oranges this is the critical rust mite spray, if the fruit has not received any previous lime-sulphate application.
9.	Grapefruit. Orange.	Probably in September or October but certainly before Feb. 1.	Oil emulsion 1%.	White fly. Scale insects.	To be given if scale or white fly is noticeable.
10.	Grapefruit. Orange.	November to January.	Lime-sulphur solution 2 gals. in 100 to 1½ in 100 gals.	Rust mites.	To be given only if rust mites are noticeable.

*The scab applications may be required on highly susceptible varieties of orange of the kid glove type.

†Required on round oranges only when thrips are abundant.

an oil emulsion, and designed to kill white fly and scale insects. It should be put on some time after the adults of the citrus white fly have stopped flying. The sooner it is done the less injury the white fly will do to the trees. In some cases the fungi have worked so well and have done so much good that it may not be necessary to apply No. 9. I forgot to state in the beginning, that the basic principle of controlling insects in Florida is to work in harmony with the beneficial fungi. If the trees are black and there are a great many insects present and scales are abundant, this application can be given in September or October; or it can be postponed until any time during the winter that the grower desires. In fact the main objection to spraying at this season is the injury that it does the fruit by the machine and teams. Some groves are planted so close that it is very nearly impossible to get a machine in the grove, and if you injure very many fruit it doubles the cost of spraying; but if the fruit is removed very early, this spraying can be given after the fruit has been harvested.

Those three sprayings are the main sprayings for the control of white flies, scale insects and rust mites on citrus; but in some places, in and around Ft. Myers, Pinellas county, and perhaps other places, if it is the desire of the owner or the grower to keep his grapefruit and Valencias bright through all the year, he will find that an application of lime sulphur will have to be given perhaps some time in January. I remember one year a certain grower had about 90% of this first grade fruit, up until very nearly the first of January. On the 10th of January I visited the grove, and I believe there must have been half a million mites on each grapefruit. Those mites didn't make what we call russet brown, but it made what are known as bronzed grapefruit, and during the last of the season the grower got only about 60% bright fruit, and the remainder mostly bronze. It is very seldom that it will be necessary to spray in the fall for rust mites.

It seems to me that perhaps this covers my side of the question, unless I should emphasize more than ever, that a spray schedule has a great many weaknesses and applies only in a general way. I visited a grove south of town here one day and I could not find enough white fly, scale insects or mites present to justify the expenditure of any money whatever. I visited a grove in another community that had practically no insects at all, and I visited two other groves in the same community and there were countless millions of white flies and scale insects present. That brings up the point that the grower will have to learn insects and learn about their abundance, if he expects to avoid the waste of a great deal of money. If the grower had followed a schedule like this, in my opinion, No. 7 would have been wasted this spring in two of the groves, and the other two of course would not. Each grower should have a schedule of his own.

Question: Please tell us about that sulphur. Is this soluble soda the common sulphur such as the druggists have?

Mr. Yothers: Soluble sulphur is a powdered soda sulphur.

Question: What effect would oil emulsion have on the fungi?

Mr. Yothers: It has been proven a great many times that the spraying with oil emulsion does not hinder the beneficial fungi at all. The use of the oil emulsion will never stop the activity of the beneficial fungi.

Question: Isn't it a safe proposition generally to use the sulphur every time you use the oil emulsion?

Mr. Yothers: I think so. I have to confess the main reason I have never recommended that was because if the growers use that combination, I always find they don't like to use the lime-sulphur solution in June. It is a case of, you might say, politics.

Question: What has been your observation on No. 7 application, in reference to the burning of the fruit or the foliage? Unless very carefully applied, doesn't the addition of the soda sulphur make it considerably more liable to cause burning?

Mr. Yothers: I have never observed that.

Mr. Krome: When I have added the soluble sulphur, I have on two occasions had quite serious burnings, once of the foliage, and the second time of both foliage and fruit. Since then I have omitted the soluble sulphur, and counted on the lime-sulphur to take care of the mites.

Mr. Yothers: I have never observed that, but it is only fair to admit that soluble sulphur, as I understand, is practically out of use. I understand it causes very serious burning on apples. I have never worked on apples, but that is my understanding; and it may cause some burning on the oranges.

Question: Has the sun any effect on the white fly?

Mr. Yothers: I suppose that it does have some, but it is of such minor importance that there is practically no killing out of the fungi.

Mr. ————: In connection with what Mr. Krome has said, we have had the same ill effect from the combination of oil and soluble sulphur. In one case we used the oil at the rate of 1 to 75 and the soluble sulphur about 2 pounds to 100 gallons, and had quite a serious burning on grapefruit. Again we tried it, making the preparation still weaker, about 1 to 100 of oil and about 1½ pounds of soluble sulphur to 100, and we found oranges were slightly spotted. Since then we have discontinued using the combination.

Mr. Yothers: For a great many years I never recommended soluble sulphur, because lime sulphur was so much more valuable and much better, but I never got any injury, and so I thought it would be a good idea to recommend adding them together.

Mr. Winston: Since scab is caused by a specific organism, and since the schedule here takes into consideration but one disease, it is probably best that we review this particular organism. The scab is caused by a fungus which lives every winter in the old leaves which are hanging on the tree. It grows best at a low temperature, about 50 to 60 deg. F., and during moist weather, a combination that

sometimes occurs in the spring, when the leaves are young and tender. We have found that the leaves are particularly resistant to scab after they once unfold (probably a half inch across), and the fruit becomes entirely resistant to scab after it reaches three-quarters of an inch in diameter. Ordinarily scab is not a particularly serious disease. The springs are usually dry or the rainy periods do not come just when the fruit is young and tender, and scab is not very serious under these conditions. This spring we had a combination of conditions which were particularly good for scab infection. We had a rainy period that continued for three weeks, resulting in a serious outbreak of scab, especially in those groves that were not sprayed, or where spraying was delayed for a long time. Doubtless you would like to know why, in some groves, this year you do not have very much infection. There are several reasons for that. The grove probably was not tender when we had the rainy season, nor were the fungus spores present in large numbers while there was some rain present. At this time, when the weather is as hot as it is, we never get any infection, because the temperature is too high. Fungus does not grow at all at temperatures above 85 or 90.

We devised this spray schedule, believing that it will under ordinary conditions, control scab. We have tried to picture to you two conditions—one where there is scab on the old leaves in considerable abundance, and where the season is rainy. In such cases we recommend the first application to be applied before the first flush opens. If you do not have any great amount of scab on the old leaves, you do not need to spray at that time. Apply the second application if there is an abundance of scab on the old leaves, and you have a rainy season, about the time the first petals begin to open. This application is not necessary unless there is considerable scab. There are two critical applications—the third and fourth. The third application should be lime-sulphur 2½ to the 100. The fourth application should be fifteen days after the third. We said seven days, in the schedule, because we know machines are liable to break. Probably ten days is all that is necessary. This spring it was not necessary, but during the spring of 1917 the fifth application was a critical one. We had a rainy season just about the time the fifth application should have been applied.

This year we had a grove out near Winter Garden, where we followed the spray schedule. We found that there was a considerable amount of scab on the old leaves. The owner didn't spray while the trees were dormant, but sprayed about the time the petals were opening, with lime-sulphur. Number 3 of the spray schedule was given as the second application and No. 4 as the third. The fruit today is practically clean.

The question arises whether to use lime-sulphur or Bordeaux mixture. However, we think we can use one application of Bordeaux mixture, preferably in the dormant period, with safety, provided you come along with one or two applications of lime-sulphur within the next four or five months.

Question: Has Burgundy mixture been used to any extent in dealing with scab?

Mr. Winston: Yes, we have tried it several years, with reasonable amount of success. It is not quite as effective as Bordeaux, but probably 5% more so than lime-sulphur.

Should Cottony Cushion Scale be Allowed to Spread, Unrestricted, in the State of Florida?

Wilmon Newell and F. M. O'Byrne, State Plant Board, Gainesville, Fla.

We have been talking about the white fly, rust mite, scab and other things, and I have noticed generally that this seems to be "Bug Day" at the Horticultural Society, so we want to take your time for a few minutes on another bug question—one that most of you do not think about very much, but one which, nevertheless, is important in a number of respects. I refer to the cottony cushion scale. The problem as to limiting the distribution of cottony cushion scale is one which is a rather sore point with some nurserymen in the State. It is rather a thorn in the flesh for those of us connected with the State Plant Board work. On the one hand, some of the nurserymen think that the Plant Board regulations concerning the cottony cushion scale are too drastic. On the other hand, there are growers who are not interested in the nursery business, who tell us that our regulations are not nearly drastic enough. The nursery inspector and plant commissioner are continually between the two fires, and we have kept our troubles to ourselves for quite awhile, but they have gotten to be most too much for us, and we propose to unload the problem on you, and get your opinion as to what we should do, or, rather, what we should recommend to the Plant Board as to what it should do. Before we get through we are going to put this question squarely up to you: "Should cottony cushion scale be allowed to spread, unrestricted, in the State of Florida?" I don't think it will take very long to state the case.

Most of you are familiar with cottony cushion scale. It is an insect that was introduced into California about 1868 or 1869. It was found that it was spread by grove laborers, and in other ways, and in a very short time it was found to be very destructive to the citrus trees and many other trees and plants in California. In fact, for a while it looked as though it would wipe out the citrus industry of that state, but in 1889 the U. S. Dept. of Agriculture sent an entomologist to Australia, and he was successful in finding the natural enemy of the cottony cushion scale there. That is the Australian ladybird or vedalia. It shortly brought the cottony cushion scale under control, and has kept it under control in California for the last thirty years. Perhaps if we had had a quarantine department here in Florida, such as we have today, we would never have had cottony cushion scale to

worry us. It came about that a gentleman near Clearwater, about 1893, heard about the wonderful work that the vedalia was doing in California, and he thought if it was good there to eat up cottony cushion scale, it might be here. He wrote to a party in California, making inquiries about the vedalia. His friend in California being very kind, not only wrote back but sent him some vedalia, and in sending the vedalia he figured that the vedalia should have something to eat on the way, so he put some cottony cushion scale in the box with them to keep them alive on the road. (Laughter.) I don't know whether that ought to be applauded or not. We have never fully approved of what that man did. But when the box of Australian ladybird beetles arrived the box was placed in the grove at Clearwater, and the Australian ladybirds released. The ladybirds apparently perished, but the cottony cushion scale did not. I merely refer to quarantine work at this time, because under the conditions we have today, a box containing material of that character would never have reached here. The cottony cushion scale spread rapidly in Pinellas county and other portions of the State, being carried mainly on nursery stock, and, following the example of California, the Australian ladybird beetle was introduced into Florida. That was in 1899 when Prof. Gossard got the beetle and brought it to Florida for the purpose of controlling the cottony cushion scale and the insect has done here what it has done in California—it has been very efficient in controlling cottony cushion scale. About the only difficulty, so far, is the fact that sometimes the ladybird gets so abundant that it eats up practically all the cottony cushion scale, and then it has nothing to feed on, and it dies out. Cottony cushion scale gets a start again, and gets very bad before the beetle catches up with it.

Without going further into the history of that insect, I shall merely jump over a period of years, and say that from the time of this little history down in Clearwater, in Pinellas county, up to 1915, when the Plant Board was created, the insect had spread pretty well over the citrus growing section of the State. When the Plant Board took up its work in 1915, it was confronted with the question of whether or not to take any measures to prevent the further spread of cottony cushion scale. It attempted, upon the advice of its Advisory committee, to formulate a regulation which would, to a large extent, keep the cottony cushion scale confined to the territory that it then occupied. The board adopted a rule requiring nurserymen located in cottony cushion scale territory, before sending out or selling nursery stock which might be a host plant of cottony cushion scale, to scrub that nursery stock with an insecticide, and to do that work under the personal direction of a Plant Board employee. That rule has been in force since January, 1916. It means that a nurseryman located in a neighborhood where there is cottony cushion scale, when he wishes to send out or ship any plant which is a host-plant of that scale, must call in an inspector of the Plant Board, and scrub that nursery stock with the insecti-

cide, under the personal supervision of the inspector. There are arguments both pro and con for that course. I don't want you to think that the opinions expressed by Mr. O'Byrne and myself are necessarily our own opinions, because our position is absolutely neutral, but we do want to place before you some of the reasons why that scrubbing requirement should continue to be enforced, and some of the reasons why it should not be enforced, and we leave it to you to be the judge of what course should be followed. (The reason I am referring to this paper is that this is Mr. O'Byrne's speech.)

Now, first of all; some of the reasons for enforcing this requirement that I have mentioned. In the first place, cottony cushion scale is a very difficult insect to control by spraying. I have heard prominent growers in this State express the opinion that if we did not have the Australian ladybird beetle, that cottony cushion scale would clean out the citrus industry of Florida in one year in spite of all the spraying that could be done and I am not sure but what those opinions are right. Whenever this pest gets started in a new place; as a rule the ladybird is not there ahead of them, and a new infestation is always a severe infestation and accomplishes considerable damage before the ladybird can be brought there and established. Now this pest is not yet distributed all over the State. This map will give you, in a general way, the territory in which cottony cushion scale occurs. (Indicates on map.) Here in the central part of the State are rather large areas in which cottony cushion scale is general. Then there are red dots at various other points where the infestation is more or less local. It is not always possible to get the ladybird beetle in sufficient quantity to control one of these outbreaks. As I said a few moments ago, the ladybird beetle has a way of eating itself out of house and home once in a while, and the ladybird beetle practically perishes, and so we have to be continually shifting ladybird beetles from one part of the State to another. It costs money to find them and to rear them. Here is another thing to be considered. Most of you will, perhaps, not think it is very important, but I don't believe it is a thing we can afford to ignore. We are depending on, in this infested area, and California is depending also upon this ladybird beetle, to hold the cottony cushion scale in check. What would happen if some insect enemy or disease would come along which would destroy the ladybird? It would be nothing less than a calamity, and if we pin our faith to the ladybirds absolutely, for the control of this scale, then we have got to take that chance. The ladybird has worked thoroughly for thirty years in California, and it is not known to have any serious fungus enemy or insect enemy. Sooner or later, every plant or animal that I know of has become subject to a parasite of some kind, which has greatly reduced its numbers. That is the law that is going to operate, sooner or later, in the case of the Australian ladybird.

Here is another consideration: If the Plant Board were to rescind its requirement that these host-plants of cottony cushion scale be thoroughly scrubbed be-

fore they leave the nursery, it is likely that many of the other states would refuse to admit nursery stock grown in Florida.

As long as the cottony cushion scale has been very satisfactorily controlled in California for thirty years by this ladybird beetle, and is well controlled by it here in Florida, why should we continue putting the nurseryman to the expense of scrubbing his trees, and why put the tax payers of the State to some expense in continuing to enforce this scrubbing requirement? The small nurseryman tells us, and I believe he is right, that this scrubbing done, as it must be, under the supervision of a Plant Board agent, whose time he pays for, makes the cost of his nursery stock prohibitive. In other words, the small nurseryman who wants to sell ten or fifteen or twenty grapefruit trees, must call in one of the inspectors, to see him scrub those trees. We charge him what that inspector's time costs us, and inasmuch as the inspector is not a salaried official, the charge for the supervision of that scrubbing is $1.00 for the first hour of the inspector's time, and fifty cents for each additional hour. From the small nurseryman's standpoint, it is a prohibitive tax upon his small nursery business. This thing affects those engaged in retailing ornamental plants, because many of the ornamental plants, sold in pots, and from the seed stores and florists' stores, are hosts of cottony cushion scale and, under this requirement, they must be scrubbed before delivery to the customer, so the rule is undoubtedly an interference, from the nurseryman's standpoint, with his business. On the other hand, there are some very large citrus nurseries located in the cottony cushion scale territory. They not only sell to people in the cottony cushion scale territory but they sell to a great many people outside of it. These people on the outside, located where they have no cottony cushion scale, want none of the trees from that territory unless they are safe from danger of cottony cushion scale. You might say that one solution of that problem would be to let the nurseryman in cottony cushion scale territory sell his trees only in cottony cushion scale territory. That would ruin the business of some of the largest nurseries in the State of Florida, because they must have this outside territory and territory in other states in which to deliver their trees; so you see that, no matter in what way you approach this problem, you are going to find objections, and valid objections, to every line of procedure that can be devised. Considering the trouble that this regulation causes nurserymen on the one hand and considering, on the other hand, the fact that the vedalia has, up to the present time, controlled the cottony cushion scale efficiently, the question is: Shall the Plant Board rescind that regulation, which would mean that cottony cushion scale be allowed to spread when and where it pleases in the State of Florida, and the only protection against it would be the ladybird beetle? I am going to turn the problem over to Mr. O'Byrne, and I think he will say what I have not said.

Mr. O'Byrne: I am going to speak only for a moment or two, because I am particularly anxious to hear from you people. What we think is of very secondary importance to what you think about this problem. We want to get a little of that burden off on to you, and we want you to tell us what you think we ought to do about it. (Referring to map.) This red area indicates the present limits of cottony cushion scale territory. It takes in Pinellas, Hillsboro and Polk counties, and a strip down the Seaboard into Manatee county. Also there is an area around Kissimmee, Orlando and the Apopka section, and in the central part of the State; isolated infestations at Ocala and Mandarin, the furthest south at Key West, and a considerable start in the Miami and Palm Beach section. You will see that this takes in the best citrus sections in the State of Florida. There is one point to be considered. All of North and West Florida has no cottony cushion scale, and they don't want it, for two reasons. Because it would be troublesome on their plants, and also because if cottony cushion scale is allowed to get into West Florida nurseries, all of the Southern States—Georgia, Alabama, Mississippi and Louisiana, into which those pecan and general nurseries ship stock, may quarantine against them.

There is one very perplexing problem which we have to face, and that is in securing good packing house inspectors. As far as the Winter Haven or Orlando section goes, it is a comparatively simple matter. There are certain sections where there are a number of nurseries isolated far from a large town, where it is practically impossible to get a real good man to act as packing house inspector, and when we are up against that, we have to take the best man we can get. If there is not a real good man out there, how are you going to get one? We are only charging the nurseryman $1.00 for the first hour and 50 cents for every hour after the second. The average packing house inspector gets about $10.00 a month, some $25.00 and $50.00 for a very busy month. How many of you are going to interfere with your work for $25.00, $30.00 or $50.00 a month?

Another point, and this is a rather sore point. Whenever the trees which have been scrubbed under our requirements, die, there is only one reason, no matter what treatment those trees were given in other ways, namely, because they were scrubbed. And that, regardless of the fact that the largest nurseries in the State are sending out thousands and hundreds of thousands of trees every year, that are given identically the same treatment, and their trees are satisfactory—they grow off well. Those nurserymen tell us that if we abandon Rule 22, they will go right ahead scrubbing their trees. Yet no later than today at noon I heard of a man who had had some trees scrubbed here near Orlando, and 70% died. Why? Because they had been scrubbed with whale oil soap solution.

There are four classes of men we want to hear from. Nurserymen, both large and small, in the section where they have cottony cushion scale; those who are grove owners outside of the cottony cush-

ion scale territory; and those that are nurserymen outside of the cottony cushion scale territory.

Question: Does the scrubbing protect us against anything else?

Mr. Newell: It greatly reduces the number of all scale insects on the nursery stock. If there happened to be a few purple scale or a few long scale on the nursery stock, we do not quarantine the nursery. We would quarantine every nursery in the State if we quarantined on account of the few purple and long scale.

Question: Is there any of this at Frostproof?

Mr. Newell: Yes.

Question: I am speaking as a grower outside of the territory. Certainly if it is at a cost of $4,000.00 to the Plant Board, I have no objection to giving my part of the $4,000.00, or even if it is $40,000.00.

Question: Does spraying destroy the ladybird?

Mr Newell: Not usually. It may kill a few very young ones.

Question: I am a small nurseryman and also considerable grove owner in the infested territory. I would ask if it would be possible to allow the infested districts to place their stock in those districts, without quarantine, or scrubbing, but prohibit sending outside of the districts infested?

Mr. Newell: No, it would not be practical, for the reason that there are many nurseries in that district that sell both inside and outside of that district. For instance, you say scrub certain trees and don't scrub others.

Question: Could you grant a permit to sell only there in their own limited district, and no permission whatever to sell anywhere else?

Mr. Newell: On the other hand, in that same district there are nurserymen that get business entirely outside of the district, and the rule would apply to all.

Question: Have you established your boundary or territory in which you refuse to let scaly bark be shipped?

Mr. Newell: Yes, but that is a very different problem, because you have no treatment by which you can rid your trees of the danger of scaly bark.

Question: Have you had any trouble in enforcing that rule?

Mr. Newell: Some, yes.

Question: Would you say it was impossible to enforce it?

Mr. Newell: No, I would not say it was impossible. I think it has been pretty well enforced.

Question: Was there any objection to that rule?

Mr. Newell: No, I think not.

Question: Why is it, if you can establish such a rule as to scaly bark, that you can't establish such a rule as to the cottony cushion scale?

Mr. Newell: That would not be practical. In the first place, it would not be right to confine a nurseryman in his sale to that cottony cushion scale territory, when it is possible for him to give those trees treatment which makes them safe from cottony cushion scale.

Question: Whenever those trees are to go into territory free of cottony cushion scale he is to have them scrubbed?

Mr. Newell: For the nursery which has customers both inside and outside of the cottony cushion scale territory must be considered. It is not practical to allow a nurseryman to scrub part of his trees and not scrub all. We would have no way of keeping tab satisfactorily. In the second place, if you follow the plan you did in scaly bark shipments, and allow him to sell without scrubbing, within that cottony cushion territory, many shipments will go right up to the edge of the territory and this will gradually enlarge the infested area. That is one of the main objections to such a plan.

Question: The man shipping this stuff into a free territory is required by you to make report to your office of what shipments he makes? An inspector also sends you a report of what his duties were and what his service was in all particulars, whenever trees are scrubbed?

Mr. Newell: Yes.

Question: You know when these trees are going into free territory and not going into free territory. Why is it, if you have got that knowledge, that you haven't that thing done?

At this point the following motion was made.

Mr. ————: It seems that the law has been working all right so far, and I move that the sense of this assembly here is that we leave the law as it is on this question.

Motion seconded.

Mr. Newell made the following statement here:

We are not contending particularly for the present arrangement. I do not wish to be construed as meaning that. If your solution is better than the one we have, or better than no solution at all, we are ready to accept it.

Motion was made and carried that this matter be taken up at the evening session.

THURSDAY EVENING SESSION.

Chairman: There is only one thing more to come up. I want to say a word about this cottony cushion scale discussion. I have not been dodging it, but I have felt that we ought to get through with the rest of our program, because if we got started on this it would take us all the rest of the evening. I myself, do not know how much good can come from discussing this matter.

Question called for.

Chairman: I don't think that the chair would want to put the motion at this time, without giving very free discussion. Of course if you order it, the chair will do as you say, but the chair thinks, as Mr. Newell has well said, that there are two sides to this question; but at this time, with the canker situation confronting us, as it does, it seems to me that every citrus grower should forget his minor troubles, unite behind the Plant Board and Mr. Newell and his assistants, and stamp this canker off of the face of the earth. That is the one thing, it seems to me, that is the important thing to do. We can't afford to dissent among ourselves. We

have got to strike this thing from Florida, or it will strike us, and I think that these minor things should go. I have felt that I don't know it all, and that these men are trained and they are thinking along these lines. I believe they are sincere, and I believe they are going to stamp the canker out; and I want to hold up their hands. I don't want to bring up this discussion at this time, because I feel that Mr. Newell feels right now that the canker has gotten a pretty good hold, and he needs every man in the State of Florida to support him, and we can't get co-operation by argument. We must get it from our hearts, and then we will stamp the canker from the State of Florida. I would like the unanimous consent to dismiss the cottony cushion scale discussion from this meeting at this time. (Applause.) There are no men more vitally interested in this thing than the men who are hurt most by the cottony cushion scale restrictions, and I ask them to be magnanimous enough, to be far sighted enough, to be unselfish enough to let this thing go for another year or two; it won't hurt them a bit to let this thing go, and may be it will solve itself. Do I have your consent to eliminate this discussion?

Mr. ————: Mr. Chairman, I move that we drop the cottony cushion question and let it take care of itself.

Above motion withdrawn and the following motion made:

Moved that the cottony cushion scale resolution be laid on the table.

Carried.

Work of the Entomological Department State Plant Board

E. W. Berger,* Entomologist.

The work can quite naturally be classified under five heads: Identification and recording of specimens received; fungus project; vedalia project; experiments; miscellaneous services.

At first our facilities consisted principally of a compound microscope and some bulletins and entomological books that the entomologist owned. Additional equipment and some necessary literature have, however, been gradually acquired, until at the present time we have a fairly good working laboratory. Some much needed papers giving original descriptions of certain insects are, however, still unavailable. It should also be explained, that in order to conserve funds, only such books and bulletins were purchased that were not readily available for reference in Gainesville.

At the present time the department occupies three rooms in Language Hall, University of Florida, and keeps busy two assistants (Mr. Geo. B. Merrill, assistant entomologist, and Mr. E. K. Bynum, assistant in entomology) and one stenographer (Miss Alice Whitman). Mr. Merrill is kept busy identifying and making proper records of all insects received. Mr. Bynum, who was transferred to the office on January 25, 1919, has grown the fungus for this season and also has charge of rearing and distributing the vedalia. Miss Whitman, besides her regular work as stenographer, makes additional copies of all records needed for filing, and keeps the accounts. The writer takes care of the correspondence, assists in the identification and recording of specimens, in the fungus and vedalia work; tries to keep himself posted on the current literature pertaining to injurious insects and their control; sees to it that necessary supplies are at hand; and otherwise supervises the work.

IDENTIFICATION AND RECORDING OF SPECIMENS RECEIVED.

Specimens of all kinds of insects are received from growers, inspectors in Quarantine Department, inspectors in Nursery Inspection Department, and citrus canker inspectors. Most of these specimens are sent in to be identified, while others are sent for examination and

*Entomologist Florida Experiment Station May 1, 1906, to July 1, 1911; State Inspector of Nursery Stock, under Law of 1911, July 1, 1911, to April 30, 1915; Entomologist State Plant Board since April 30, 1915.

advice as to methods of control. Specimens sent by growers are largely of the latter class. The inspectors in the Quarantine Department are required to send all specimens of insects collected from shipments of plant material arriving in Florida to the Plant Board offices at Gainesville for identification by the Entomological Department. The inspectors in the Nursery Inspection Department likewise send all specimens that they cannot themselves identify, to Gainesville. The canker inspectors naturally find many specimens in regard to which they, or the owners whose properties they are inspecting, would like to have information, and these all find their way to the Entomological Department for identification or recommendation as to treatment. Mr. Geo. B. Merrill does most of this work, and has become very proficient in the identification of many kinds of insects received.

Records.—Four records are made for each specimen received or identified.

The Report, the principal record, so-called because copies are generally furnished to one or more of the other departments (always to the Nursery Inspection Department) or to the sender of the specimens, contains all information received with the specimens. These reports are made on letter-size blanks prepared for the purpose (See reports following.) and are filed according to the locality from which the specimen or specimens were received. For specimens collected by the Quarantine Department, a slightly modified form of this report is used.

STATE PLANT BOARD OF FLORIDA.

Gainesville, Fla., May 8, 1919.

*Report of Specimens Examined.

Locality—Non Such, Fla. Property—John Doe.
Report to—Nursery Inspector and Doe.
How received (mail, express, etc.)—Mail.
Collector—Chas. Dickens. Sender—Dickens.
Date collected—May 6. Date received—May 8.
Referred to Entomological Dept. by—Dickens
Identified by—Geo. B. Merrill. Specs. filed where —Laboratory.
On leaf, bark, fruit, root—Leaf.
Infestation (Severe, medium, few)—(a) Severe. (b) few.
Approximate number alive (Indicate in per cent.) —(a) 70% (b) 20%
Young or crawlers (Many, medium, few, none)— (a) Many (b) none.
Newly set (Many, medium, few, none)— (a) Few (b) none.
Letters—May 1, Dickens to Ent. Dept. State Plant Board.
Remarks: 10 Mango leaves; 4 rose leaves.
Rec. No.—a71319. Common name.—Insect, Mango Soft Scale; Host, Mango. Species.—Insect, Coccus mangiferae; host, Mangifera indica.
Rec. No.—b71320. Common name.—Insect, Rufous Scale; Host, Rose. Species.—Insect, Selenaspidus articulatus.
Note—Always put number on letter, specimens, slides, etc.
Signed—Geo. B. Merrill, Asst. Ent.

The Notes in Triplicate are copied by the stenographer from the Report, on 4x6 blanks, and contain only such information as one would expect to find in a brief record of a specimen (See illustration). While a report may contain the data for as many as 6 specimens, each Note in Triplicate contains the data for one specimen only. As the name indicates, three copies of these notes are made. One copy is filed under the name of the insect, the second copy under the name of the host-plant, and the third copy is kept outside of the building to insure the safety of at least one copy should fire destroy the rest.

*Fictitious copy of report made by identifier on letter-size blanks. Notes in Triplicate and numerical record are made from these, after which Report is filed in Locality File.

STATE PLANT BOARD OF FLORIDA.
*Notes In Triplicate.

No. 2149.
Common Name. Black Fly.
Species. Aleurocanthus woglumi.
Host Plant. Citrus.
Species. ----------
Locality. Havana, Cuba.
Property. Passenger.
Collector. E. L. Gehry at Key West, Fla.
Sender. Gehry.
Date Collected. Jan. 2, 1918.
Date Received. Jan. 7, 1918.
Identified by. E. W. B. & F. F. Bibby.
Specs. filed, Attic ----, Laboratory ----x, Slide--
On leaf. x, bark------, fruit------, root------
Infestation, severe -----, med -----, few x
Approx. no. alive (in per cent.) Probably all.
Young or crawlers, many,--, med,--, few,-- none--
Newly set, many----, med----, few----, none----,
Letters ----------
Remarks: Black Fly slight on 4 leaves in a total of 30 to 40. Eggs, larvae and pupae, but no adults.

A Numerical Record is also kept in 4x6 notebooks. This might better have been kept in some large volume, but as a plentiful supply of the notebooks was at hand these were used; and they lend themselves readily to filing in a suitable drawer. In these books the records of specimens are entered by number in consecutive order, with name, host, locality, date and collector.

Specimens.—Much of the work of the Plant Board being in the nature of a police agency, it follows that not only proper records of all injurious insect specimens be made, but that the specimens also be kept as evidence should legal proceedings arise. As a rule, all specimens are saved, although we make a few exceptions. Good specimens are mounted for use in identifying like specimens, or demonstration and exhibition purposes, or kept in ant-proof boxes in which they can also be fumigated. (It may be a surprise to some of you to learn that we have much difficulty in keeping insect collections from being destroyed by ants and other small insects.) Some specimens must be kept in alcohol or formalin in order to properly preserve them. Specimens of apparently but little value are filed according to host plants in pasteboard boxes in the attic. The injured parts of host-plants, especially in the case of scale insects and the like, are always saved when practical with the insects upon them.

The value of old specimens, even if only poorly preserved, was forcibly demonstrated to the writer some years ago when nubifera, or cloudy-winged white fly, was found to be present in Florida. The question arose: What is the distribution? Careful examination of about a bushel of old specimens, with localities and dates marked upon them, that had been left by my predecessors, at once gave us some idea of this. A similar instance, illustrating the value of old specimens of plant material, occurred some years ago, when Professor P. H. Rolfs was investigating the withertip disease of citrus and some other plants. Examination of material accumulated at the United States Department of Agriculture, Washington, D. C., at once revealed

*Actual record of specimen collected. The interception of this material by the Assistant Quarantine Inspector of the Plant Board may have been the means of keeping the Black Fly pest, already becoming so destructive on many plants in Havana and Nassau, out of the U. S. for an indefinite period. One copy of this record is filed under Citrus, another under Black Fly, and a third copy is kept outside the building for safety in case of fire. Copied from a "Report of specimens examined."

to Professor Rolfs that withertip was not a new disease in Florida, but that either a virulent strain had been recently introduced from elsewhere or had originated here. In either case we got ready-made information which would have required many months to accumulate otherwise. In other words, if a record of an injurious insect is of importance, how much more important is the specimen with the injured part of its host! because many errors or omissions in records can be corrected only by referring again to specimens.

Results.—No. 4514 was the last specimen recorded on April 29, 1919, the last day of the past fiscal year. Several hundred more specimens have been examined and identified since the Entomological Dpartment was established (April 30, 1915), but as a regular numerical record was not kept during the first five or six months, these are not included in the 4514. During the past fiscal year (April 30, 1918, through April 29, 1919) 1,921 specimens were examined and identified.

Should any of you come to the Entomological Department, and I should be glad to have more of you call on us at Gainesville, we could in a few seconds time hand you a complete list, on the Notes in Triplicate, of all the insects received from citrus trees in the State of Florida; this list would probably include all insects existing on citrus in Florida. We could likewise show you a handful of notes listing all the insects received on pecan, mango, or almost any other plant. On the other hand, we could show you a pack of notes giving all the host plants of almost any injurious insect in Florida that you could name.

Again, right now we could go to our Locality File and show you a complete list of insects received from 323 localities in Florida, and 36 out of Florida. Our Locality File is, furthermore, almost an absolute necessity for the proper distribution of the pure cultures of the fungus parasites of the white fly, and of vedalia, and is continually referred to for that purpose. Should Jones, for instance, owning a grove near Orlando, order twenty cultures of fungus without specifying the kind, I could safely include five to ten cultures of the Yellow Aschersonia, which is the particular parasite of Nubifera, or cloudy-winged white fly, without any further correspondence or sending specimens, as our locality file shows Nubifera to be present at Orlando. Needless to state, we are rapidly adding many white fly records to this file. Or, a man may order a colony of vedalia, and our locality record does not show the presence of cottony cushion scale in his locality. We then write him to send us specimens, as we do not like to waste vedalia by sending it where it is not needed, or take chances of introducing cottony cushion scale in new localities, because a few scale crawlers might inadvertently be on the vedalia sent. Needless to state, we occasionally receive mealy bugs from persons who think they have cottony cushion scale.

We like the Numerical Record because we can so readily get from it the number of specimens received by the department during any specified period of time, or

can at a glance know the amount of identification work that has been done. Also, the numerical record is sometimes useful for locating the complete record of a specimen of which the number only is available.

Again, we have incidentally established an Insect Survey of Florida, by simply keeping accurate records of specimens people send us for identification and advice, with but little additional expense. In other words, we have undertaken to conduct this business in a business-like manner, and the more specimens you send us the more complete our record will become.

Finally, at least thirteen species of scales, and some other insects heretofore unknown to exist in Florida, have been received and identified. One of these is the famous Dictyospermum scale, famous as the worst pest of citrus in the Mediterranean countries. In Florida it has shown no disposition to become a pest, and while its distribution is such that eradication is out of the question, it is nevertheless being watched by the Plant Board.

FUNGUS PROJECT.

The fungus project at present consists in growing the Red Aschersonia and the Yellow Aschersonia in pure cultures. These are two of the three principal fungus parasites that destroy large numbers of the common and cloudy-winged white flies of citrus. The Red Aschersonia has also been found destroying the inconspicuous white fly, or sweet potato white fly, and an unknown species on custard apple. The importance of using pure cultures for introducing, or spreading, these useful fungi is apparent when we consider that there is absolutely no danger of introducing some disease or insect with them. Such a danger does exist when fungus material is collected for this purpose from groves. This danger became a serious menace when citrus canker occurred in the State. To obviate this danger, the growing of these fungi in pure cultures was undertaken.

The cultures are grown in pint widemouth bottles on sweet potato agar. Three or four plugs of sweet potato (yellow kind), together with a gram of agar and 50 cubic centimeters of water are placed in a bottle, stoppered with cotton batting and sterilized with steam for 20 minutes at 15 to 20 pounds pressure. The hot bottles are allowed to cool in a slanting position so that the jelly-like agar and potato harden against one side of the bottle, and form what is known as a sweet potato agar slant. Fungus spores are then introduced into each bottle in a sterilized compartment, or hood, and the bottles set aside for the fungus to grow. The young growth at first appears (4-6 days) as numerous minute, whitish spots, which soon enlarge and generally grow to form a continuous creamy-white, mold-like sheet over the potato and agar. After two to six weeks (depending upon temperature), considerable red or yellow begins to appear on the surface. This red or yellow is the spore formation of the Red Aschersonia and the Yellow Aschersonia respectively. The spores may cover the culture more or less as a continuous sheet or in spots and larger areas. A cul-

ture is quite complete, or ripe, in four to six weeks.

The pioneer work in growing these fungi was done at the Florida Experiment Station by Professor H. S. Fawcett during and prior to 1908. The spore-spraying method of introducing fungus into white-fly-infested trees was perfected by the writer during about the same time. The practical side of growing large numbers of these fungus cultures came largely later. Without wishing to enlarge on the difficulties encountered, the fact has been repeatedly demonstrated that the period of May, through September, is too warm for successfully fruiting fungus in bottles, so that the supply must be grown earlier (January to May).

Another fact is becoming more and more apparent, that we cannot expect every culture made to produce a salable one. This year, it appears, 60% will be salable, which is our best record. In previous years we sometimes averaged as low as 17% during the season. A few cultures, for some unknown reason, never start to grow or have a poor catch only. Some become contaminated with moulds or bacteria, while more fail to fruit sufficiently.

Owing to an increase in practically all lines of work, it was found necessary to employ another assistant. Mr. E. K. Bynum was placed in charge of the fungus work, under direction of the entomologist. Mr. Bynum has done well and will have to his credit approximately 4,000 salable cultures, principally of the Red Aschersonia, and some of the yellow. He began work about February 1. In the year 1915 (spring and summer), 147 cultures were produced and sold; 1916, 298; 1917, 757; 1918, 1,156. While the bulk of all cultures sold went to the citrus-growing sections proper, some were sent as far west as Wewahitchka, near the Apalachicola river.

It is part of our plans, provided the Legislature is generous with the Plant Board, to conduct experiments* in growing pure cultures of the brown fungus and at least one or two of the scale fungi, particularly the red-headed scale fungus, which is an efficient parasite of the San Jose scale of peach trees, as well as of a number of other scales on pecans, citrus, maples and oaks.

Directions.—Printed directions for introducing fungus accompany each order, the following being an exact copy:

STATE PLANT BOARD OF FLORIDA.

Department of Entomology.

HOW TO INTRODUCE THE RED AND YELLOW WHITEFLY FUNGI (RED ASCHERSONIA AND YELLOW ASCHERSONIA).

By E. W. Berger, Entomologist.

In order to start a growth of the Red or Yellow Aschersonias, it is only necessary to spray a mixture of the fungus spores with water on to the whitefly larvae in the infested trees. The spores of the fungus are produced in enormous numbers in the red or yellow portions of the cultures furnished by the State Plant Board. These spores vary considerably in size, and 13,600,000 to as many as 52,000,000 could be arranged one layer thick upon the surface of a square inch.

*Since writing the above, the Legislature has reduced the funds deemed necessary by the Plant Board, and Mr. Bynum will be transferred back to the Nursery Inspection Department on July 1st. This means that it will not be possible to conduct the experiments projected.

HOW TO MIX THE FUNGUS.

To make a mixture of the fungus spores and water, mix a culture, the contents of one bottle, with 70-100 gallons of water. Less water may be used when it is desired to apply a greater number of spores per tree. The culture should, however, first be thoroughly mashed, by hand, potato masher or other implement, in a pint or quart of water, in order to free the spores. After thoroughly mashing the culture in water as just directed, add a gallon or two of water, strain through coarse cheesecloth, and dilute to make 70-100 gallons. When more than one culture is employed, all can be mashed and mixed with a definite quantity of water at one time, and from this, as a stock solution, quantities representing one or more cultures be measured out for diluting and spraying, as needed. Mixtures of fungus spores and water have been allowed to stand for 24 hours, when necessary, without deteriorating.

The culture may be extracted from the bottle by means of a clean stick, table knife, spoon or other implement. If the bottle has a narrow mouth, break the bottle. The strainings left in the cheesecloth should not be thrown away, but added to the next culture, as there will always be some spores left in them. The cheesecloth should be rinsed in a little clean water in order to rinse out any spores caught in the fiber, and the water used in mixing the next culture.

Cultures arriving in broken bottles should not be discarded but used the same as other cultures. They should be used at once or within 2 or 3 days.

APPLYING THE FUNGUS.

It has been calculated that a fungus culture is sufficient for about 70 to 100 large trees, thus allowing about one gallon of spray per tree. Spraying with fungus differs from spraying with insecticides in that it is not necessary to spray the whole tree, but only portions of it. For large trees it has been found quite sufficient to spray a ring or belt of foliage half way between the top and bottom, although more of a tree may be sprayed if fungus is plentiful. On smaller trees proportionally more of the foliage may be sprayed, or the whole tree sprayed. It is advised that trees from three to five years old, inclusive, be sprayed all over, in order to assure a good start of fungus, which does not always thrive so well in smaller trees as it does in larger ones. It is also advised that trees less than three years old be sprayed with oil emulsion instead of fungus, since the conditions generally surrounding such trees are unfavorable for fungus. It may be stated again that more or less fungus can be used, depending upon the amount available. The important thing is to get some fungus started in each tree when, if weather conditions are favorable, it will rapidly spread to all parts of the trees.

Since the whitefly larvae live on the under sides of the leaves, the spray of fungus spores and water must be directed against that side. Also since the newer growth is regularly infested with whitefly larvae, this should receive especial attention and be thoroughly sprayed in perference to the older growth.

SPRAYING MACHINES.

Spraying machines and other containers made wholly of brass or copper should not be employed. Copper is a fungicide and may interfere with the germination of the spores. Use only new sprayers, and barrels and tubs that have never contained a fungicide. Compressed air sprayers of galvanized iron have given good satisfaction. The Lowell Compressed Air Sprayer has the brass air pump attached on the outside where it does not come in contact with the liquid, and this, or a similar sprayer, is recommended. Barrel sprayers and power sprayers may be used for larger areas, and of these the barrel sprayer is probably sufficiently large and has been successfully employed by the writer. Use good pressure and a nozzle that produces a fine misty spray. With a compressed air spray, 30 lbs. is probably the limit, but with a barrel sprayer use about 90 to 100 pounds pressure. When there are only a few trees to be treated, dip small twigs into the mixture of spores and water, made more concentrated, or apply with a whisk-broom.

WHEN TO APPLY FUNGUS.

Apply fungus immediately preceding a period of rain, if possible; it may also be applied during the intervals when it is not raining or immediately after a rain. The spraying should not be done while the trees are still wet with water, since that would have the effect of further diluting the spray mixture. One of the most luxurious growths of the Red Aschersonia that the writer ever succeeded in getting was during a period of rain in April, 1908. The fungus was applied during the day and followed by a heavy shower during the evening. More trees were sprayed the next morning following a wet night. But generally speaking, the period of summer rains has been found to be the most certain period in which to spread fungus and to introduce it into new places. Periods of moist weather are generally not to be expected before sometime in June, during July, August, and to the middle of September, and we do not advise introducing fungus during periods of dry weather or during the winter because it will not thrive well at that time.

Growths of fungus can generally be observed with the unaided eye in about three weeks, seldom

earlier, after spraying the spores, provided the weather conditions have been suitable. It will sometimes happen, however, that if the application of the fungus is followed by a dry period that but little of the fungus will show up for several months, and it may become necessary to make another application in order to get a good start.

STORING FUNGUS

Fresh looking (bright red or yellow) cultures may be kept for three or four weeks by placing them in a dry cool place or in an ice-box. They have been kept alive for a year in the cold-storage room of an ice factory where the thermometer registered between 40° and 45° F. The stoppers must not be removed before using, neither should they be allowed to get wet. Cultures of red fungus that are dull dark red, or yellow fungus from which the yellow has faded, should not be kept over 10 days before applying it. Stored cultures should be examined once or twice per week and if infected with mold should be used at once as otherwise the mold will ruin the culture.

MISCELLANEOUS.

In the process of growing the cultures many so-called ½ cultures are produced. These contain about ½ the number of spores of a regular culture and are sometimes included in shipments, two or even three being given for one. These ½ cultures are marked by a rubber band about the neck of each bottle and should be used 2 or 3 as one.

Growers having no other use for the empty bottles are requested to return them express collect whenever the express charges to Gainesville will not exceed 7-8 cents per bottle.

COST AND REMITTANCE.

Since the Plant Board has no appropriation to cover expense of growing this fungus, it has been decided to make a nominal charge of 75c per culture, **Transportation Charges To Be Paid By The Purchaser,** in order to in part compensate for the actual cost of production.

Remittances should be made by check or money order payable to the "State Plant Board of Florida" (Postage stamps cannot be accepted). Address: "Entomological Dept., State Plant Board, Gainesville, Florida."

Orders for fungus cultures should be accompanied by check therefor, as these cultures are furnished the growers at actual cost and can be sold only on a cash basis.

Name nearest express office when this is not the same as the postoffice address.

Orders for fungus of one to three cultures will be sent by parcel post, only when necessary postage money is included with remittance. Shipping weights: 1 culture, 2 lbs.; 2 cultures, 4 lbs.; 3 cultures, 5 lbs.

Gainesville, Fla.

VEDALIA PROJECT.

The vedalia, or Australian Lady Beetle, is the natural enemy of the cottony cushion scale. As most of you know, this scale was introduced into California from Australia in 1868, and from California into Florida in 1893. This pest became very serious on citrus, and but little progress in its control was made until the vedalia was also brought from Australia to California in 1888. After 1893 the Vedalia was introduced into Florida, and now effects an almost perfect control of the cottony cushion scale wherever found. Besides citrus, cottony cushion scale infests hundreds of other plants, including pecans, peaches, roses and other ornamentals.

Since 1893, the scale at first spread slowly from Keene, in Pinellas County the original infestation in Florida, but in recent years more rapidly. Growers soon learned that the vedalia was the best remedy, but had great difficulty in getting colonies. The Plant Board decided to fill this need as far as possible, and during the past fiscal year (1918-1919) 218 colonies of 10 to 15 vedalia each have been furnished growers; 1917-1918, 193 colonies, and 1916-1917, 172 colonies. The price is $1.00 per colony, approximately the cost of rearing or collecting and handling them.

The supply is maintained partly by rearing them in the laboratory, partly by having Plant Board inspectors in the field collect them. As the vedalia feeds only on cottony cushion scale, we al-

ways request growers who order vedalia to send us some scale. At other times we appeal to the inspectors to collect it and send it to us. It does not often happen that we run short of vedalia. At times we have quite a supply of the pupae (resting state) in which stage we generally send it out, on hand. Such supplies are kept in a refrigerator at a temperature of forty to fifty degrees Fahrenheit, until needed. Should we run short of a supply of food, we place the rearing jars with the immature larvae in the refrigerator, to make them dormant, until more food is obtained. Our supply of food (cottony cushion scale) is also kept in the refrigerator.

Since January the vedalia work has been in charge of Mr. E. K. Bynum, who has been very successful with it. The experimental work was conducted by the writer during 1915-1916, and it took some time to perfect the present method of handling it. Previous assistants, namely, A. C. Mason, C. E. Wilson and F. F. Bibby, also had charge of the work during part of the time that they were with the Department.

CAMPHOR THRIPS PROJECT.

In March, 1916, 300 small camphor trees (3 feet high) infested with the camphor thrips were obtained, treated with insecticides, and planted apart in eighteen groups in out-of-the-way places and in the forest belonging to the University.* The object of the experiment was to determine whether it would be possible to treat thrips-infested camphor trees after digging and before re-planting in such a manner as to rid them of the thrips.

Six groups were dipped and scrubbed or sprayed with fishoil soap and Black Leaf 40, or fishoil soap alone, using soap 1 and 2 pounds per 10 gallons of water, and Black Leaf 40, 1 and 2 parts to 800. Three groups were dipped and scrubbed with 2% oil emulsion, with Black Leaf 40, 1 to 800, in one of the three. One group was dipped and scrubbed with 3% kerosene emulsion. Two groups with Barium testrasulfid, to one of which Black Leaf 40, 1 to 800, was added.

One group with lime-sulphur solution, 2 quarts to five gallons water. One group with powdered lead arsenate, 3 pounds to 50 gallons water. Two lots were fumigated with hydrocyanic acid gas, using one ounce sodium cyanide to 100 cubic feet of space, time 30 minutes. Two lots were not treated and used as checks.

To date no live thrips have appeared on any of the trees. One group of 16, however, cut back to 2 inch stumps, dipped and scrubbed, root and all, with 2% oil emulsion, lived much better, as 14 out of the 16 trees lived, than any other group, except one of the checks, in which 15 out of 16 grew.

In December, 1916, another lot of camphor trees, infested with thrips, was treated and planted. This was done at the request of Mr. F. M. O'Byrne, the Nursery Inspector. The trees were selected and treated at the nursery by one of the Assistant Nursery Inspectors (Mr. U. C. Zeluff) and shipped to Gainesville.

*Camphor thrips had then already been present on the University campus for a year or two..

The treatment consisted in cutting the trees back to 10-inch stumps and dipping them in double strength oil emulsion (Yother's Formula). There were 103 trees and these were planted under supervision of the writer, in one long row (about 200 feet long) on top of the west slope of the gully to the west of the Experiment Station Building. To date no living thrips have developed upon these and 87 out of the 103 are growing.

The results of cutting back and treating these two lots of trees with double strength oil emulsion has been made the basis of a ruling in the Nursery Inspection Department, to the effect that trees so treated, provided they did not show thrips lesions, may be sold from thrips infested nurseries.

MISCELLANEOUS.

Cryptochaetum.—Cryptochaetum is another useful parasite of cottony cushion scale, that was introduced into California at the same time with vedalia. This is a small, two-winged insect, or fly, that deposits its eggs into the immature stages of the scale. The young, or larvae, develop inside their host and eventually kill it. In March, 1917, a splendid colony of about 150 or 200 specimens was received gratuitously from the California State Insectary, through the courtesy of Mr. Harry H. Smith, Superintendent. Part of these were colonized by the writer at Stanton, Florida, in the property of Dr. R. L. Lytle, and part (the larger part) at Winter Haven, Florence Villa and Lucerne Park by Mr. J. Chaffin, Assistant Nursery Inspector.

Cotton Seed Fumigation.—In order to check the more rapid spread of the cotton boll weevil, the Plant Board required that all seed coming from weevil-infested territory, whether in Florida or other state, to be fumigated with carbon bisulfide. This work was assigned to the Entomological Department. During 1917-1918, 2,006 bushels were fumigated, mostly in the fumigating box at Gainesville. Since the weevil has now entered practically all the cotton growing areas in Florida, this requirement was discontinued in 1919.

Other Experiments.—In order to get information necessary or important for the conduct of the work of the Plant Board, other experiments are occasionally conducted. Thus the effects of a number of dipping solutions on some insects likely to be found on old field boxes or on tree material likely to accumulate in field boxes are being conducted. Fourteen solutions are being tried out on thrips, aphids, whitefly and scale insects. Each solution consists of a well known germicide and an insecticide, or supposed insecticide. These tests are being conducted in co-operation with the Citrus Canker Department.

Sundries.—Sundry other duties devolve upon the Entomological Department. One or other of the assistants may be sent into the State to investigate an outbreak of some insect pest, or the Entomologist may go. Thus Mr. E. K. Bynum was recently sent to Moore Haven, in response to a telegram from Governor Catts, on account of an outbreak of the Florida flower thrips on

peanuts. Last July the writer went to Vero on account of the semi-tropical army worm outbreak on castor beans. Part has also always been taken in the Citrus Seminar conducted annually at Gainesville, and occasionally in the program of the Florida State Horticultural Society. In January of this year, part was taken in the Farmers' Short Course at the university, and in February thirteen days were spent away from the office in connection with the Better Fruit Campaign.

CONCLUSION.

Finally, are we taking ourselves too seriously? I believe not, when I think of all the many questions that we are asked in regard to the location, distribution and treatment of pests, many of which we cannot as yet answer.

Has the Peach Tree Been Given a Fair Trial in Florida?

J. R. Watson, Florida Agricultural Experiment Station, Gainesville, Florida.

I am not coming before you this evening with the idea of giving you an authoritative treatise or advice on peach growing. Frankly I know very little about any phase of the industry except some of the enemies of the trees such as insects and nematodes, and not any too much about them. My purpose is rather to stir you up and get some ideas from you—a purely selfish motive. I want to know. So if I seem to be taking the attitude of a propagandist for peaches, it is solely for the purpose of drawing your fire. What are the difficulties which confront the Florida peach grower? Why is the peach industry of Florida less extensive than that of many states, and especially Georgia?

Florida has certain obvious advantages for peach growing. There is, for instance, a certain market. For early varieties at least she has the market practically to herself, no serious competition.

Again, a peach orchard can occupy light soils which are not particularly valuble for general farming, land which, for instance, will hardly produce a profitable crop of corn. I hope no real estate booster will take serious offense if I venture the opinion that Florida has an acre or two of such light soil. In its labor requirements, the peach fits in well with our other crops inasmuch as its greatest demand for labor during the shipping season, comes at a time when other farm and especially grove operations are not pressing.

Like any industry anywhere, peach growing doubtless has its difficulties. Are those of Florida insurmountable? Are they in fact any more serious here than in other sections with an important peach industry? What are some of these problems? There are, I suppose, cultural problems concerned with the selection of proper varieties, the proper cultivation, fertilization, pruning, and perhaps irrigation of the grove. Have we in this field problems which are more serious than those which confront the growers in other states? I pass this question on to someone who knows more about it.

There are, I know, climatic difficulties to meet, such as low winter temperatures and late frosts. In the extreme northern states even dormant trees are often killed by extremely low winter temperatures. This trouble we escape. Then there are the late frosts which catch the trees after they have commenced to blossom. This trouble we do have, for almost any frost after the middle of January is, for the

peach, a late frost. But I cannot see that this problem is any more serious here than in many highly developed peach sections. The Colorado grower is convinced that it pays to fire a blooming orchard. If it pays in Colorado perhaps it would pay in Florida; or perhaps not, because the bloom does not all come out at once but comes straggling along during many weeks. While this may be an argument against firing it works the other way in respect to the late frost problem as a whole. Small matter if the first blooms are killed; there will be others.

Then there are problems connected with co-operation among the growers, particularly in marketing. If the industry ever becomes large in Florida such co-operation will become essential. Only last week I was told by a man connected with the Agricultural Department of Georgia, who should be a disinterested authority, that the Georgia Fruit Exchange was all that had saved the industry in that state. And not only has the industry there been saved but it is expanding rapidly in the southern part of the state. The Exchange handles 85% of the Georgia crop.

Lastly we come to the question of parasites, fungus and animal. First the fungi. Are they worse than in other states where the industry is more extensive? It is generally recognized that the high humidity of our climate, especially during the rainy season, is highly favorable for the growth of fungi. In no other state, at least, do the entomogenous fungi (those that grow on insects) flourish as here. But the peach grows largely during our dry season. Plant pathologists generally do not seem to regard the fungus enemies of the peach in Florida to be unusually serious.

Coming now to the animal parasites, nematodes and insects, naturally it is here that I have come into most intimate contact with peach growing. And with reference particularly to insects I make bold to assert that the Florida grower, as a whole, has hardly given the peach a fair chance.

Our insect problems are no different nor more serious than in any flourishing peach growing section; in fact some are less serious and others are entirely lacking, as for example the Oriental Peach Moth, a recent importation into Maryland and adjacent states.

Taking up first the insects in the order of their destructiveness, we have that little round scale which, outside of California, is called the San Jose Scale. In California they object to such a pest carrying the name of one of their communities, and call it "the pernicious scale,"—and it surely is pernicious. This scale is decidedly less fatal to peach trees here in Florida than in other states, thanks entirely to our entomogenous fungi. It is these fungi and not the growers who have heretofore been chiefly instrumental in saving the trees. However it is not fair to lay the whole burden on the fungi. We should give them more aid. During the dry spring months the fungi do not grow as well and the scales are apt to get a start, increase rapidly and become a serious drain on the trees at the very time when the trees are maturing their fruit and often in the face of a severe drought. If the trees are made reason-

ably free of scales in the winter they should not become heavily infested before the rainy season sets in and the entomogenous fungi again become active.

As a control measure we have nothing better to suggest for the winter clean up than lime sulphur solution, 1 to 8. This must, of course, be applied when the trees are dormant, which usually means December or early January, except perhaps in the extreme northern part of the state. In most of the states the trees are apt to start to bloom in late January. In the summer we have another control measure at our service, *i. e.* the spread of the entomogenous fungi, the Black, the Gray-headed, and especially the Red-headed Scale Fungus. By spraying the spores of these fungi through the orchard in late June or July we can usually start an epidemic among the scales that will keep them in check until time for the dormant spray again. As a source of these fungi to spray on peach trees it will be safer to obtain them from citrus trees infested with purple scale than to obtain them from other peach orchards. There will then be no danger of introducing the spores of some peach disease with the entomogenous fungi.

After the San Jose scale the borers are the most dangerous insect pests. These are the caterpillars of moths which lay their eggs on the larger limbs as well as on the trunk. The young caterpillars are not able to penetrate the dry hard bark of the exposed parts of the trees but crawl down to the moist bark below the surface of the ground. Here they enter the bark, working in the outer layers at first, but gradually mining to the cambium, inner bark and sapwood where they work until the following spring. In the more northern states the moths do not emerge until July and there is but one generation per year. In Florida I have caught the moths as early as April and it is probable that there is another partial generation. But here also the important brood is the fall one.

The time honored method of control consists in mounding the trees with earth about July first. This is to induce the borers to enter the trunk higher up where they can be more readily reached. In October this mound should be leveled and the young borers scraped off the bark. At this time they have not entered the bark deeply and a gentle scraping of the bark will remove most of them. A few weeks later and perhaps a third time during the winter the trees should be gone over again and the borers removed. By this time the borers will be large enough to cause the trees to exude considerable gum at the wound so that the worms are usually easily located. They should be dug out with a knife, care being taken not to cut across the tree and thus partially girdle it. Sometimes a wire may be run up the burrow and the worn killed.

A few years ago a device was invented which was designed to keep these borers out of a tree. On top of the mound, a disk of tarred paper with a slit on one radius and a hole in the middle to receive the trunk of the tree is placed around the tree and sealed to it by a paste which soon hardens. The larvae in descending the tree encounters this tarred paper, follow it down and are deflected off into mother earth at a distance

of a foot or less from the tree which the tiny creatures are usually unable to reach again. In a quiet protected situation these tree protectors seemed to work well but in an exposed field the wind bends the trees and cracks the hardened paste. As a result the tarred paper disks have not not proven an entire success.

More recently considerable success has been reported by placing about the tree on top of the mound a ring of crystals of paradichlorobenzene. The larvae as they crawl down the trunk are "gassed" by the fumes given off by the crystals. Whether this will work as well during the Florida rainy season as it is said to do during the drier summers further north we hope to be able to report later.

The curculio perhaps ranks third among our insect pests of the peach. This is a weevil, and, like other members of the group, has a long snout with which it punctures the young fruit. It makes two kinds of punctures. One is a small hole in the skin where the insect inserts its beak while feeding on the interior of the fruit. The other puncture is for egg laying. It is a slit-like pit, large enough to receive the eggs; immediately under it the female cuts a crescent shaped slit which projects slightly inward and under the eggs. It is an old enemy of peach and plum growers and the methods of controlling it are well known.

The insect spends the winter in trash such as weeds, under old boards, and other shelter. An important step for control therefore, is to clean the orchard.

After the young grub in the fallen fruit has completed its growth it goes into the ground for a month or so. For this reason thorough cultivation is an important method of keeping down the curculio. As the insect is rarely more than an inch or so beneath the surface, cultivation need not be deep but should be thorough enough to break up the pupa cases and kill the insects. In Florida this cultivation should be continued until July. Chickens running in the orchard will be a great help. The trees should be well pruned, all dead wood should be cut out and the crown should be opened to let the sun in.

If the tree is large and casts a dense shade, the fallen peaches should be raked out in the middle of the row so that the sun can shine upon them and kill the grubs inside.

All of the above measures should be taken by the careful grower even if there is no curculio present.

For spraying use lead arsenate and spray the trees three times. The first spraying should be applied just as the calyxes (shucks) are shed from the blossoms. At this time use two pounds of lead arsenate paste to 50 gallons of water and pour into the mixture the milk obtained from two pounds of fresh lime. Two or three weeks later a second spraying should be applied. At this time one should spray also for brown rot of peaches so that it is necessary only to place 2 pounds of lead arsenate in each 50 gallons of the spray used for brown rot. This is a self-boiled lime sulphur. A month before the fruit ripens a third spraying should be given with self-boiled lime-sulphur solution alone. Do not put the lead arsenate into this third spraying as it has been found that peach

trees will not stand three sprayings with lead arsenate well in one season.

Another weevil, the plum gouger, does about the same sort of injury and can be poisoned in a similar manner.

Last of all we have the root-knot nematodes to contend with. Of the animal parasites of the peach this is the only one which is probably more destructive in Florida than in other peach growing states. Root-knot nematodes are partial to sandy soil and cannot endure in a climate in which the soil freezes to a depth of many inches. Both of these factors reduce its ravages in the states to the north of us.

The common practice in Florida is to set out peaches only on newly cleared land in the expectation of getting enough paying crops to justify the cost before the nematodes get into the grove and kill the trees, the early death of the trees being expected. The nematodes are invariably introduced sooner or later on tools or the feet of workmen or horses or by other means. The life of the orchard can be prolonged by taking rigid precautions to remove all dirt from tools, shoes, and horses' feet.

There is a common idea that planting cowpeas in the orchard will introduce root-knot. While it is not true that the worms are likely to be introduced by this means it is true that any small colonies already established will be greatly multiplied. For this reason the use of cowpeas should be avoided unless one can secure pure seed of such resistant varieties as the Brabham or Iron. There is practically no remedy for an infected tree. Fumigation with carbon bisulfid will kill many of the worms and delay the death of the tree but it is an expensive and only a partial relief.

Apparently the best solution of the nematode problem is the use of plum roots. The native plums are highly resistant to nematodes. Some growers have reported unsatisfactory results with trees on plum roots. Some of them claim that the trees do not bear well. Other growers, and in my experience more growers, regard the plum roots as quite satisfactory. Others report trouble at the point of union due to the more rapid growth of the peach. This seems to be largely a question of the location of the union. It seems to be pretty generally agreed that the union must be well down in the ground where it will be constantly moist, on the roots in fact.

Question: Is the peach tree affected by withertip?

Prof. Watson: I believe there is a disease called withertip of the peach. My idea is that it is a different withertip from that on citrus trees. That is my impression.

Question: I found some trees in Titusville that had gone back. A party asked me what the trouble was, and I would like to get some information on it.

Prof. Watson: It sounds like San Jose Scale.

Question: The root apparently was healthy. There was no insect pest as far as one could see.

Prof. Watson: It might be the Peach Yellows.

Mr.————: I would suggest that those trees have outgrown their roots, because they have never been pruned. I have seen those trees around Titusville myself, and they look like a tree that has not been pruned. They have simply sprouted at the bottom, and the top died back.

Question: Can you suggest the quality of soil that the peach tree should be planted in to best advantage in Florida?

Prof. Watson: I would refer that question to some horticulturist.

Question: Is it better to have a clay sub-soil?

Prof. Watson: Yes, I have seen groves on light sandy soil, with clay sub-soil. Perhaps some of them do not have this sub-soil.

Mr. Poole: Any soil that will grow a citrus tree will grow a peach tree.

Prof. Watson: There have been one or two cases reported to me of San Jose Scale getting on a citrus tree from a peach tree, but it did not become established there.

Question: Is it a good plan to have a clay sub-soil for peaches?

Prof Watson: I don't know for sure about that.

Mr. Tippin of Vero: Would you advise pruning back every year?

Prof. Watson: I am not a horticulturist, but I understand that is a nearly universal practice among the horticulturists.

Question: Did you mean to bud on a plum root, or to graft?

Prof. Watson: Graft.

Mr.————: In regard to peaches on plum root, I think Mr. Ira Soar can give you some interesting information about that.

Mr. Soar was asked to tell something about his experience with peaches on plum root.

Mr. Soar: With peach stock we found that the root knot usually got the tree, regardless of what care we gave them in order to keep the root knot in check, before we could get enough fruit off the trees to make it worth while; so we took up the growing of the trees on plum roots, and obtained very good results. The plum root does not solve all the questions of peach growing, but it solves the question of the root knot. In using the plum root we have grown them on light sandy soil. We can replant trees in the same orchard, which we cannot do with the peach root.

In regard to pruning, I believe that pruning a peach tree is just as important as any other practice in regard to a peach tree and is next in importance to cultivation and spraying. I think it is fully as important as spraying, because the pruning is very essential in a young tree in order to get the maximum growth out of it. After the tree has reached the fruiting stage, it is then important in order to get large fruit continually from year to year, and to keep the tree in a healthy condition. My father has had peach trees to live and produce good fruit from twenty-five to twenty-nine years of age. This is absolutely impossible, under ordinary conditions, without proper pruning. The ordinary peach tree will die at from seven to ten years without pruning, and

will last from fifteen to twenty years, with proper pruning. When it reaches that age the pruning is very important. We have a very imporant advantage in Florida over some states further north, in that our fruit comes off earlier in the season, and gives us time to prune our trees back immediately after the fruit has been removed. We then have time enough to grow a new fruiting top before Fall. In the states further north, where they have a shorter growing season, it takes nearly the whole season to produce a crop of fruit. In pruning they have to prune in the winter, and thus shorten the crop for the next year. By pruning in the summer, we have the growth replaced that summer, and by the next spring the tree has finished that succulent growth; while in the case of winter pruning on an old fruit tree, we have a growth in the spring, which retards its development and ripening from one to two weeks.

Question: May I ask Mr. Soar what the nature of his pruning is; whether particularly on new growth or some other growth, that keeps them so long?

Mr. Soar: A young tree is pruned back and set out in winter, and let grow all summer. Next winter we prune it back. We usually do that the second year. The third year we leave most of the growth on until after the fruit crop is off, then cut the tree back and open up the center so as to let the sun in. Then the tree makes a good growth, a very rapid growth during the summer, until in the Fall. In this case, under normal conditions, the only pruning that is necessary then is to cut the tree back a little.

Question: What variety of plum do you bud to?

Mr. Soar: The native variety is the variety that we have had most success with in getting a vigorous type. Some are very small. Then the point of the union is very important. It is necessary to bud beneath the surface of the soil. If you bud above the ground you will not have good results as in budding orange trees. I have seen larger plum trees top budded and good results obtained, but top budding on small trees will not give good results.

Mr. Tippin: I had an object in asking that question about pruning. I am very glad now that I raised the question, and I want to add emphasis to what this gentleman has stated, based upon a wide experience. I came from the peach belt of South Missouri, when I came to Florida three years ago. I have been a shipper of peaches from Michigan, Arkansas, Missouri and from Georgia, and am well acquainted with all the large peach districts in the United States except on the East Coast to the north, and the gentleman has very aptly advocated the customs usually practiced in all of those sections, as to pruning, and I want to emphasize that the facts which he has told to you who grow peaches or expect to grow peaches in Florida, are very important and very valuable, and especially the fact that the longevity of your peach tree depends very largely on systematic annual pruning.

Mr. ————: In peach trees on plum roots I found that the tree tops would die after they produced one crop. The trees were very vigorous, started off and made

about three or four months' good growth. Then every one would die down to the union. A few months later on plum sprouts began to come up, and from those roots I grew a bunch of the finest wild plum trees you ever saw, and as far as the root knot was concerned, I am certain that that was a fact, because a number of the trees that I kept for seven or eight years have been worth while simply for the wild plums. The fruit was a small, very dark plum. After seven or eight years I dug them up, and there was no evidence of root knot. As far as getting a peach tree was concerned, it was an absolute failure.

Mr. Soar: I would not say that I could answer that without having seen the trees at the time. I could probably have told what was the matter with them. Sometimes it is the case that a peach tree set on plum roots will make a very vigorous growth, and it will overgrow the root to a certain extent. In a case of this kind it is very important to prune the tree back at once, so that it will allow the growth of the root to catch up with the top. It will cause the crop to grow more gradually, so that there will not be that choking. If you set a graft a number of inches above the root system it will cause an overgrowth of the peach on the plum. By cutting the tree back at this stage, you can often alleviate it to the extent that the tree will recover itself, and make a good growth.

Mr. ————: Has any one ever tried the wild cherry? Would the peach grow on wild cherry?

Mr.. Soar: I do not think that the wild cherry would be very good. I have never tried grafting the peach in the wild cherry, but I have tried to graft tame cherry into the wild cherry, and have never yet been able to make one live for any length of time.

Mr. ————: I have had experience in that line. I have grown peaches four to five feet high on the wild cherry.

Reminiscences

E. S. Hubbard, Federal Point, Florida.

Coming from Middletown, Conn., I landed at Federal Point from the steamer Rosa, Capt. Joe Smith, Sept. 3, 1880, to clerk in the store of my uncle, Capt. Edwin Smith.

The people were talking about planting strawberries. In 1876 J. C. Folsom, who with his partner, J. E. Tenney, founded Federal Point, while riding horseback in the country back of what is now Hastings, noticed in the garden of a native farmer a bunch of strawberry plants full of large red fruit. When the runners were made he secured all he could get and the next winter carried the fruit in milk pans out on the wharf and sold them to passengers of the numerous river steamboats, then the only means of traveling in Florida south of Jacksonville. Bowen Brothers of Mandarin became interested and built a lot of refrigerators, the largest holding 480 quarts; and in 1879 Federal Point shipped 40,000 quarts and Mandarin 20,000. The first berries to go into market sold for $5.00 per quart and when the price got down to $1.00 per quart the growers stopped shipping and sold the remainder of the crop in local markets. The first winter I was here the plants began to rust, which summer killed both old plants and runners so largely that the growers shifted to Wilson's Albany, a poor berry comparatively, and the original "Federal Point" berry became extinct. This was before the day of knowledge as to fungi and fungicides.

That winter I made my first visit to the Mays' orange grove at Orange Mills, which with the Rembert grove at Drayton Island were the two oldest orange groves in Florida. These groves were planted by Zephaniah Kingsley about 1824 (Kingsley was one of the most unique characters in Florida), after it was ceded to the United States by Spain in 1821. He occupied Fort George Island at the mouth of St. Johns river: Was sugar planter, slaver and accused of piracy. Fort George Inlet empties into the ocean just north of St. Johns river jetties. Kingsley's fast schooners traded across to Africa and evaded discovery by being moored against the rocky bluff at the north end of the island, their rigging being festooned with Florida moss. Kingsley married an African princess, and his two daughters, for a consideration of $20,000 each, were married to two Englishmen. Their descendants are still living.

There were 3 or 4 acres in the original part of the Mays grove. They were sweet seedlings with two to five trunks, having been killed to the ground in the 1835

freeze. There were three types of oranges in the original grove, a round full colored orange not quite so fine flavor as Homosassa; a lighter colored orange slightly flattened and not quite so sweet—an Azorean type; and a very sweet oblong orange known as "Early Oblong," or "Sweet Seville." As the St. Johns and Ocklawaha rivers, with the stage line from Palatka through Ocala to Tampa were the only means of travel in the early days, it would seem that most of the sweet seedling orange trees in Florida were propagated from seed from the Mays and Rembert groves.

The Dancy grove at Orange Mills, 1859, the Hart grove at East Palatka, 1859, the Speer grove at Sanford, 1842, and the Stark grove at Enterprise somewhat later, were the same types of oranges, and the improved varieties, Dancy's old Vini, Homosassa, Stark's seedless and Parson Brown appear to me to be crosses of the Mays' round and early oblong oranges.

There were small yard groves about St. Augustine and at Picolata, which was quite a settlement with a convent, in the early days, being the point of crossing the St. Johns river on the King's road to Tallahassee. Wild sweet oranges were found in the hammocks at New Smyrna after the Civil War, but the Mays and Rembert groves were the only ones of any size set in grove form in the early days.

I was informed by Mr. Andrew Yelvington of Hastings, after the 1895 freeze, that his grandfather told him when a boy that the 1835 freeze killed very few orange trees to the ground, but that on the 15th of April the same year there was a killing frost that killed most of the sprouts that came out on the orange trees cut back by the February freeze and that but few orange trees survived this frost.

A good many small orange groves were started after the 1835 freeze, but the long scale made its appearance and few trees survived the scale.

The orange grove set out in 1824 by Kingsley at Orange Mills, was for some years before the war owned by Dr. Mays, who with his brother-in-law, Col. Cole, had a large sawmill there. There was a wild sour orange grove on the Cole place adjoining the Mays grove and Mrs. Mays was an enterprising woman who more than doubled the size of the Mays grove, the addition being largely budded with her own hands on sour stock. On my first visit to the Mays grove there were four or five good sized grapefruit trees on the place loaded with fruit. They were looked on as a curiosity at that time and I remember young people of the party cutting them in halves and on tasting the bitter tissues, throwing them on the ground. It was some ten years later before public attention to any extent was drawn to grapefruit as a tonic dessert fruit.

When I first came to Florida complete commercial fertilizers were practically unknown. Professor Atwater of Wesleyan University, Middletown, Conn., for three or four years had induced several farmers to use nitrate of soda and muriate of potash in connection with raw bone

and super phosphate for field crops. Edmund H. and Walter N. Hart, my future brothers-in-law, were growing young orange trees by mulching the rows between the trees with wire grass and growing cowpeas in the middles with "Ash Element," which was half Charleston phosphate floats and half kainit. They got an immense growth of pea vines, which supplied the nitrogen for vigorous tree growth. It was several years before Forrester's complete chemical fertilizer, composed of sulphate of ammonia, dissolved bone black and double manure salts 4-6-12 came into general use in their groves. People in those days sometimes paid dearly for ignorant fertilizing. Some pioneers at one place were interested in linseed oil mills and applied linseed meal heavily to bearing orange trees. The first year there was a marvelous crop of fruit, the second year a good crop, but about the fourth year a new disease, limb blight, appeared and experts from the U. S. Department of Agriculture could discover no bacterial infections. A friend who had been having good results from Mapes' fertilizers decided to give his trees a change of diet and applied only Canada wood ashes. The fruit was small and sour and the next year he had limb blight. A neighbor planted 100 young orange trees with a quart of cotton seed meal under each tree and lost every tree. A Jacksonville fertilizer company put out a potash and phosphate fertilizer, which I think was similar to ash element, at a much higher price, claiming the orange trees would find nitrogen enough in the soil and another neighbor who used it one year never did bring his trees back to their former condition before the '95 freeze.

Times have changed in other ways.

At its annual meeting in Palatka in the winter of 1887, the Florida Nurserymen's Association took measures to organize a Horticultural Society. The Florida Horticultural Society was organized at Ocala, April 10, 1888, later to be chartered as the Florida State Horticultural Society. The newly organized Horticultural Society invited the American Pomological Society and the Georgia State Horticultural Society to meet with them at Ocala at the Semi-Tropical Exposition, February 20, 1889. At this exposition was the greatest display of varieties of citrus fruit that has ever been made in Florida before or since. Four of the largest exhibitions had from thirty to fifty or more varieties of oranges alone. Competition was keen for the premiums for the best collections of 20, 15, 10 and 5 varieties and for the best orange of any variety and the American Pomological Society gave silver and bronze Wilder medals to the best exhibits. Some of the nurserymen may have them, but I doubt if any orange grower can exhibit a collection of ten varieties now, and I suppose only a very few members of our State Horticultural Society now ever met the pioneers who blazed the way and did the experimental work that has resulted in the stable conditions of Florida horticulture today.

A. I. BIDWELL.

Mr. Bidwell, when I came here, had a nursery at Arlington, below Jacksonville.

He was the first man to experiment with Peen-to peach seedlings and introduced Bidwell's Early and Late peaches and the Seminole, also the Giant Loquat. A. H. Manville was also in the nursery business, but later edited the Florida Dispatch, which was a most important public forum for discussing horticultural problems and shaping the tendencies of horticultural growth. Colonel Codrington started the Florida Agriculturist in DeLand and introduced Para and Guinea grass some 40 years ago. People who now look to the State Experiment Station for testing out all agricultural and horticultural problems can hardly realize the importance to the State in the early days of one single contribution to general welfare and knowledge.

REV. LYMAN PHELPS.

Mr. Phelps was superintendent of General Sanford's Bellair orange grove at Sanford for a time, and did more than any other man to test out the numerous varieties of citrus fruits General Sanford imported. Major O. P. Rooks first called attention to the King orange, James Mott to the seedless grapefruit, R. W. Pierce to the Ruby blood orange, E. H. Hart introduced Hart's Tardiff, now commonly called Valencia late orange. Mr. Hart during his life did as much as any one man experimenting with and testing out rare palms and plants. It was his hobby and recreation. He was continually receiving and searching catalogues of all the European seedsmen for ornamental novelties. He had the rare faculty of knowing how to make plants grow. Think of the patience it takes to continually water slow germinating palm seeds for two or more years. This is only a partial list of the men who contributed in the early days towards making the Florida we have today though it is a different Florida than we had before the 1895 freeze.

The old experimenters with their visions and euthusiasms are nearly all gone and instead we have comparatively standardized and stabilized conditions with problems of diseases, insects, fruit handling, transportation and selling which were the lesser troubles in the good old days.

Paper No. 4 from Committee on History.

Some History of the Pioneering Days of the Citrus Industry

M. S. Moreman, Switzerland, Florida.

When one takes a bird's-eye view of the citrus growing sections of the State as it is today, it is difficult to even imagine conditions confronting the pioneers of the industry.

For the most part, those of us who came early in the 70's found an almost unbroken wilderness, roadless, and but few inhabitants.

April 10th, 1870, I arrived in the city of Jacksonville. The place impressed me as a very young city, just emerging from the village conditions; having ambitions and expectations based upon the growth of a vast citrus industry. Every one I met talked orange growing. On inquiry I learned there were several groves scattered about, the annual output being about 50,000 boxes. I say boxes. In reality there were very few boxes as of this day. It was barrels, bags, drygoods boxes, any old thing that could be used to carry oranges.

On every side one heard of the extraordinary trees at Mandarin, twelve miles south of the city. The old Fatio grove at Switzerland, Col. F. L. Dancy and Dr. Mays at Orange Mills, Hart at Palatka, Speer grove at Millenville, Dammitt grove, Starke grove, and others.

The writer under many difficulties visited many of these groves. After journeying for three months by steamboat, sail boat, row boat, ox cart, and afoot, I covered a very considerable portion of eastern Florida.

In August I purchased my present homestead. Under many difficulties lumber, bricks, lime, nails, etc., were brought to the place by a sailing lighter. Some way a house was built—the very dear old house that houses the writer today. A house around which many pleasant and sacred memories twine.

Land clearing commenced in October of 1870. Trees were planted February, 1871, seedling trees. Four grew to be 35 feet tall and when I sawed them off in the spring of 1895, they measured 20 inches across the stump. These were prolific seedlings, many of them producing 20 boxes to the tree. There were 1,300 of these trees. Later, when budding became fashionable, I added 1,500 budded trees of what was then thought to be the best varieties. I selected for the main planting the Homosassa, and I think it hard to beat, even now.

Talking of varieties, very little was known of varieties, and little thought

given to it. An acquaintance had a seedling grove. Also in the town, which then was quite a tourist town, he had a store. In order to meet the demand for certain varieties, he provided a row of neat bins labeled with the names of the various varieties, but was careful to put into each bin certain sizes. The African Sweet was his favorite. It was a small russet of about 250. Now these different bins were frequently filled from the same tree. But they answered his purpose and his customers were satisfied.

At first no wraps were used. Later wraps became fashionable. No such wraps as we use today. Old newspapers were cut into squares, or torn into pieces for the purpose. Sometimes very ludicrous pictures were presented.

Lumber was secured from the mills undressed. For ends and middles inch-boards were used. For sides ½-inch stuff was used. These boxes were of irregular sizes. Oranges were not sized, but counted into these boxes. The number of oranges in the box was placed on the end of the box instead of the number showing size, as now. I think Mr. E. Bean, then of San Mateo, conceived the idea of a standard box and size. By perseverance he succeeded in having his idea generally adopted. From this starting point orange packing rapidly advanced. We all know the development of today.

The selling of the fruit in those early days was not much of a problem. The Seaboard Citrus commencing with Savannah, absorbed the entire output. Buyers came to the groves paying for the oranges by the thousand. Col. F. L. Dancy sold the fruit from 85 seedling trees to Capt. Rose of the steamer Lizzie Baker, a boat plying between Palatka and Savannah, for the sum of $1,600. Dr. Mays sold his crop from 200 seedling trees for $4,000. So it was for all groves accessible to water transportation.

The news of this wonderfully profitable industry was spread abroad. It attracted many, and induced large investments. Indeed, I know of one instance where a party wired a real estate agent to buy land for orange growing. He could not wait to write. He thought his opportunity would be lost.

By 1885 the crop had increased to about 600,000 boxes. Expense of production, harvesting, etc., had all increased. The competition plan of selling had become almost universal. That is, A would send his fruit to Commission Merchant B to be sold against his neighbor's fruit in the hands of Merchant C. The crop sold in 1885 as far as could be gathered at that date, averaged about 50 cents per box on tree.

These conditions gave rise to a selling organization, known as the Florida Fruit Exchange. Conditions greatly improved under the influence of this association of growers. The Exchange was rapidly extending its influence, creating central packing houses, educating the producer up to better marketing methods, and no doubt in time would have brought about the best possible marketing conditions.

The destruction of the groves occurred February 7th, 1895. This closed the ef-

forts of the Exchange, and the first chapter of the citrus fruit growing in Florida.

What has happened since then is so recent it is hardly necessary to reduce it to history. So someone else can open the second chapter.

Paper No. 5 from the Committee on History.

The Principles of Landscape Design

Randolph Townsend Wedding, Landscape Architect, St. Petersburg, Fla.

Fineness of relation is the basis of all art and "Simplicity is the keynote of all great art."

Nowhere does the happy combination of simplicity and fine relations produce such magic results as in the fine art of landscape designing.

Good art of any kind demands good composition. The basic principles of design are found in the masterpieces, not only of painting and sculpture, but of poetry, eloquence, music, architecture, pottery, etc. All owe their beauty to that fineness of relation established by good design.

A good piece of landscape design is rarely an accident. The laws of beauty have been established and only by working in accordance with these principles can we create beauty with certainty.

Good sense and good taste are not synonymous, although at first sight they seem to be. The ability to enjoy does not necessarily presuppose the ability to create. And, certainly, until we have mastered the alphabet of good taste, we should employ the trained artist to design our plantings. Many planting problems are simple; and it is with the hope of helping the public to plan without professional aid, where their problem is not complicated, that the present shortened analysis of planting principles is offered. Appreciation is the only highway to the temple of art. Analysis of beauty by its fundamental laws will induce the ability to create. Imitation and caprice bring no increase of power.

There appears to be a general conviction among the builders of homes that the assistance of a trained architect is necessary. That this assistance has been beneficial is easily seen by comparing the homes of today with those of 100 years ago. This is the tangible triumph of the specialist. For various reasons, this tendency to use trained designers has not become so universal in the improvement of the surroundings of the home. The bare and cheerless aspect of so many houses shows that their owners lack proper appreciation of the value of the landscape designer and, frequently, even of the value of the plants.

But the large and increasing number of people of culture who are availing themselves of the specialist in securing the maximum of beauty in the setting of their homes and the beauty of many places already at maturity, which are an inspiration alike to the landscape designer and to the client, are sufficient proof that the American people can and do appreciate the merit of good designing when af-

forded an opportunity to compare it with the indifferent results attained by the untrained.

Great landscape designers, like great poets and painters, are born, not made; but these sons of destiny must work faithfully to be able to express themselves perfectly. We cannot all be Reptons or Olmsteads; but we can easily acquire the power to work a vast and beneficent change in the appearance of our homes if we will study a few of the main principles of beautifying the home. By intelligent study, we increase our ability to enjoy not merely our own, but the worthy plantings of everybody else.

Composition, then, of all kinds, is the "putting together" of lines, masses and colors to produce a harmony and this building up of a harmony is the fundamental goal of the supreme artists of all time.

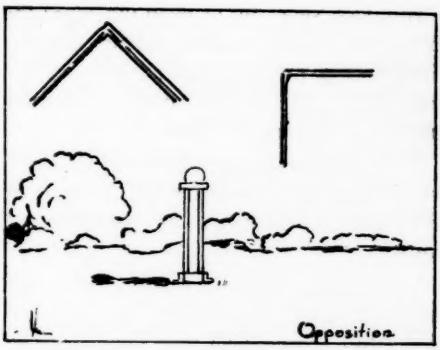
The groundwork of all composition is proportion, and in landscape design this is known as *space composition.* The feeling for space composition is the chief difference in the work of the masters of landscape and that of the worthy plodder. The element of proportion enters into every tiny bit of every plan. The proper amount of foliage mass as against the open lawn, the size of the plants and the location of them; the color scheme; everything, in fact, in any composition must be subordinated to proportion, or *space composition.*

Subordinated to space composition, we have only five basic principles of beauty. They are present, in every worthy design in the world, either singly or in combinations.

They are:

1. *Opposition.*
2. *Transition.*
3. *Subordination.*
4. *Repetition.*
5. *Symmetry.*

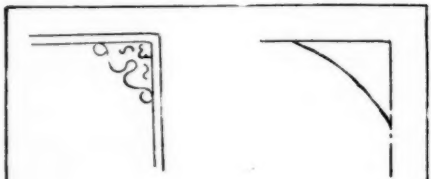
To some of you, no doubt, the names are meaningless as terms of art; but let us see how infallibly they appear in every work of art you know. Let us analyze them so we can recognize them wherever they may appear, and the grand result will be that we will attack problems of art and good design with loving interest and a growing ability to solve them, instead of timidly believing that a work of art requires the hand of a heaven-sent genius. Remember that genius in most cases means only an "infinite capacity for taking pains."



1. *Opposition*: *"Two lines meeting form a simple and severe harmony."*

"Examples are found in Greek doorways, Egyptian temples and early Renais-

sance architecture; in plaid design; and in landscape where vertical lines cut the horizon, such as trees, walls of buildings, etc."



2. *Transition*: This involves a step beyond Opposition.

"Two straight lines meeting in opposing directions give an impression of abruptness, severity, or even violence; the difference of movement being emphasized. If a third line is added, the opposition is softened and an effect of unity and completeness produced."

This combination typifies beauty itself which has been defined as "Elements of difference harmonized by elements of unity."

"Examples of Transition are the bracket, where the straight line is modified into curves which may be elaborated in great detail."

Instead of a drawn line of transition, there may be only a suggestion of one; *a softening of the corner angle* is the important thing in Transition. "In pictorial art, the vignette; in architecture, the capital are examples of this. Accidental transitions occur in the branching of old trees where the rhythmic lines are unified."

3. *Subordination*: "Neither of the foregoing principles is often found alone as the basis of a single work. Transition in particular, usually serves to harmonize the various parts of a composition. Subordination is a great constructive idea in all arts."

"To form a complete group the parts are attached or related to a single dominating element which determines the character of the whole."

A tree trunk with its branches is a good type of this kind of harmony, the relation of principal and subordinate, down to the veining of the leaves, a multitude of parts organized into a simple whole. "Subordination is the principal element in the spacing and line rhythm of the cathedrals of Salisbury, of St. Maclou of Rouen and the Taj Mahal; in Millet's Goose-girl; in some Byzantine design and

Persian rugs. It governs thedistribution of masses in dark-and-light composition, and of hues in color composition. It appears in poetry (The Odyssey for example) in the subordination of all parts to the main idea. It is used in musical composition."

"Whenever unity is to be evolved from complexity, confusion reduced to order, power felt, then will be applied the creative principle called Subordination." This principle may be applied in three ways:

1. "By grouping about an axis, as leaf to stem, branches to trunk."

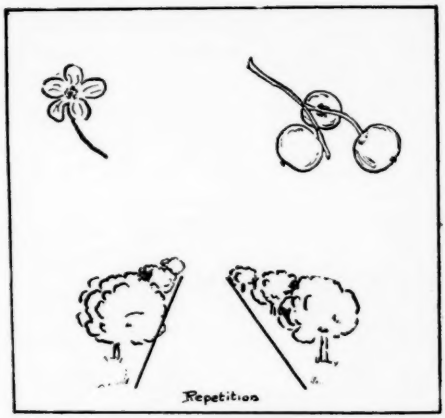
2. "By radiation, as in flowers, the rosette, vault ribs, the anthemion."

3. "By size, as in a group of mountain peaks, a cathedral with its spire and pinnacles, tree clusters, or oriental rug with center and border."

Mere geometric radiation or conventional branching is only commonplace. A work of fine art constructed upon the principle of Subordination has all its parts related by delicate adjustments and balance of proportions, tone and color. A change in one member changes the whole.

4. *Repetition*: This name indicates the opposite of Subordination. *"It produces beauty by repeating the same lines in rhythmic order."* The intervals may be equal or unequal, as in patterns or as in landscape.

"This is the most common and probably the oldest form of design. It seems almost instinctive, perhaps derived from the rhythms of breathing and walking, or



the movement of ripples and rolling waves. Repetition is the basis of all music and poetry. The savage has a drum to mark the rhythm of his sacred dance. From the crude rhythm of the Australian song 'Eat; Eat; Eat,' the world has moved towards the supreme." This movement gave us the verse of Sappho, probably the most beautiful sounds ever produced in language. The march of Repetition has carried us from rude patterns marked on bowls with sticks, to the jewel patterns of the Moguls and the colonnade of the Parthenon.

Repetition alone may be like doggerel rhyme, but with fine space composition becomes a builder of art fabric.

5. *Symmetry*: "The most common and obvious way of satisfying the desire for order is to place two equal lines or shapes in exact balance, as in a gable, windows each side of a door, or objects on a shelf. This term applies to three and four-part groups, or anywhere bal-

ance is made; but roughly it refers to a two-part arrangement. It is illustrated in the human body, ships, furniture, books, etc." But Symmetry without proportion is cheap unless due regard is paid to beauty of form. It produces an effect of repose and completeness, it is severely beautiful, as in a Greek vase. Its chief use in landscape is to give balance and is found necessary in developing a formal garden.

These five principles, singly or together, are the basis of all good art. When we see that art is not complex and mysterious and that the experience of all artists has led them to accept these principles as representing the best, it becomes easy for us to design a landscape with assurance and with power.

We will now take up the vital points in producing a beautiful planting and will show how these points, agreed on by the great landscape designers, conform in the minutest detail to the five principles we have just discussed.

The first step in making a home is building the house. In designing the house the size of the grounds, the elevation, the contours and the surroundings should all be studied carefully beforehand and the site should be selected and then we are ready to make an intelligent study of the house design. To secure the highest utility the house should be built to fit the most desirable approaches, and above all, it should have a proper proportion with the size of the grounds and there should be provision for enough open lawn to secure good space composition when everything is finished. By space composition we here mean that the group of masses should be skillfully interwoven with the group of open spaces.

When the house, outbuildings, pergolas, fences, etc., are built, we have different lines converging with the line of the ground and this is *Opposition*. The good architect who makes house and subsidiary buildings of the same type is consciously, or unconsciously, working in *Subordination* and *Repetition*.

The landscape architect always provides a planting in the house border to harmonize in size and in color with the house itself. He will not put trees in the house border of the little cottage nor will he plant geraniums in the border of the big one. There must be a proper relation between the size of the house and lot and the plants used with them. I have seen a little house shrinking away from one large date palm that threatened to smother it, and I have seen a three-story house with a house border of phlox 6 inches high. The border planting should be of sufficient size to provide adequate

Transition from the house to the grass. No house "fits the ground" unless it has this transition.

The angles made by houses, fences, or by walks and drives should be planted, no matter where they occur, and this planting, which is done by all landscape designers, is called by us *Transition.*

The heavy plantings of a lawn should be in the house border, chiefly of shrubs, and on or near the property line, where we may first plant a hedge, if desired, then plant tall trees, then smaller and finally shrubs in edge facing the house. This gives transition with the trees and gives finish to the tree mass and, finally, furnishes good *Subordination* to the dominant mass of the house. It has been said that "a lawn without grass is like a man without a face." It is certainly true that we do not need argument to convince us that the place with a carpet of grass to connect the house border with the heavier plantings near the property line is more beautiful than one without it; but few know that the grass is vitally necessary to give unity to the *Subordination* of the whole layout.

Much stress is laid on the use of native plants in landscape composition and this is right, not because some great authority says it, but because if a house is to fit its surroundings, the plants themselves must give proper *Repetition.*

We hear much about color schemes, some saying color is of prime importance, others saying that it is not worth considering; but let us look into it from the standpoint of *Subordination.*

Colors can and should be grouped like trees and under the same principle, that there be come dominant color with which the rest should be associated and in harmony. Study the great paintings of the world and you will find this true. Color grouping is just as important, but not so noticeable as the grouping of the buildings and plants.

When we plant the salients and produce deeper bays and recesses, we certainly make things more beautiful; but we are merely accenting *Space Composition* and *Transition.* Shrubs at the salient certainly give transition to the lawn and providing spaces *of different size* in the right place is the acme of space composition.

In the small city lot and frequently in the country where there is plenty of room, it is sometimes best with symmetrical houses to plant with *Symmetry.* Walks and drives are best as a usual thing near the border of the property and in *Repetition* with the plantings, but sometimes the *symmetrical* entrance is best, as the half circle walk or drive terminating with the house at the apex. Lay-outs like this can and should be planted symmetrically, trees or shrubs in pairs, or with masses balanced. The symmetrical treatment is the well-known formal garden. This should never be attempted except with a house that will justify it.

The finest streets in the world are planted with the same tree, as near as possible of the same size and at uniform distances. All other treatment of streets is cheap and amateurish. The street is a fixed line, consequently no opportunity

offers to introduce space composition; the curb forbids. Repetition will make this street beautiful like nothing else, it gives it simplicity, dignity, adds to the apparent length and no other arrangement so thoroughly satisfies.

Study the needs of your home; work out the color scheme, the texture, the massing, the light and shade. Design it on paper and, as you design it, test the worth of the design by those basic principles which govern all good designs.

When you have done the best you can, then plant it, trusting the bountiful hand of Mother Nature to reward your efforts with unexpected loveliness, with light and shade, with color, with texture you never dreamed of when you designed it, and, more, she will generously spread a curtain of green leaves over your mistakes.

General Landscape Art

L. S. Barber, State College for Women, Tallahassee, Florida.

With the varied and inspiring scenery of our country, as a background, it is possible for almost every farm home, at least, to have an ideal environment. But how many have it? A relatively small number. Has the influence of this generosity of nature with all its wealth had a tendency to make us wasteful, and cause us to undervalue beauty in our surroundings or, has it tended to make us preserve it and appreciate it? Are we not daily, recklessly destroying trees? We begrudge a living for our lawns, trample their edges and cut them with foot paths. We build terraces and leave them bare, or they are plowed down by the tread of untrained feet.

Many people have difficulty in finding time to beautify their homes. Often in the development of a new country like our own, mistakes are made that later cannot be undone.

Among the English colonies in the early settlement of our country, much attention was given to beautifying the homes, since the colonists had come from an environment where the beautiful home was the rule rather than the exception, but in the struggle that followed colonial life and all that was a part of it was largely forgotten.

In recent years there has been an awakening of interest in the home environment. Many are beginning to learn that some of the pleasures for which we live do not come to us through greater incomes. This may apply especially to our home surroundings.

The following quotation from E. G. Davis seems appropriate: "The improvement of home environment is today desired and attempted by many persons, perhaps with indifferent success at first. The man with sufficient wealth may seek the professional advice of a landscape architect with the possibility of a greater degree of success. But the face of our country will be changed to a cultivated and beautiful one only when the interest in such matters becomes universal. Homes, lawns, and gardens everywhere, whether they are large or small, whether belonging to the rich or to the poor, all require the touch of the interested individual; with such interest and ensuing effort and enthusiasm, a beautiful result must follow. All art has sprung from such inspired desire and enthusiastic effort; so must come our art of gardening.

"Now, one may see on every side the evidence of growing and widespread interest in landscape work, and its possibilities as applied to rural homes as well as to towns and cities." Bear in mind that

nothing was ever made beautiful by decoration alone. If the settings of our homes are not pleasing in their bare simplicity they are little better for any kind of embellishment.

Fundamental to the good appearance of a home environment, whether it be a farm house, a village lot, or property in the city, is the proper arrangement of all that is a part of it. There are given areas with special arrangements for each.

The dealing with these principles of arrangement and adaptation of land for use, as a home, for school ground, and other public institutions is known as landscape art.

Usefulness is secured by good arrangement and is maintained by neatness, skill, and care. A property well arranged and cared for will become more and more beautiful.

An arrangement is good when it is convenient, when it is appropriate, when it is beautiful. The plans for the various kinds of grounds in order to be fitting will vary greatly. But there are a few principles common to the making of simple home grounds. With an understanding of these fundamentals we are better able to handle our individual problems in the home or school grounds.

Good arrangement deals with three essential things—the house, the open areas about the house, public and private, and the boundaries.

THE HOUSE.

Under this four things are considered:

1. *Location.*

a. Stable condition of ground for a site.

b. Stability and availability of surrounding areas for their respective uses.

c. Outlook both off the property and on the property.

2. *Orientation.* Other things being equal, the house which faces south or southeast is the best.

3. *Protection* from wind and sun. Protection from wind is secured best by a group planting of evergreen trees, which gives the house a proper setting or background, cedar, magnolia, cherry, laurel, live oak, and camphor are among the best for Florida. Protection from sun is secured by shade trees as the American elm, sycamore (Oriental plane tree), sweet gum, silver leaf maple, beech, and linden, all of which are deciduous.

4. *Adornment by Planting.* The character of this is influenced by the nature of the open areas which surround the house.

a. *The Open Areas*: These are generally named as follows: Public, private, and service, although these distinctions are not always made.

1. *Public Area* or *Front Lawn.* The public area should have a simple dignified treatment to conform with the uniform quiet appearance of the street. The planting here should be simply trees, grass and normal green foliage shrubs which, while perhaps attractive in flower or autumn color, yet maintain good foliage through the summer and good form all the time.

2. *Private Area* or *Side* or *Rear Lawn.* In the private area may be planted annuals, lawn, shrubs, or trees, according to the size and form of the area. The rear ground is the best place for the flower garden framed in by the lawn nearest the front, a border of low flowering shrubs between the lawn and flower garden, on the opposite side of the flower garden tall shrubs with a background of evergreen magnolias, cherry, laurel, cedar, etc.

3. *Service Area* or *Back Yard.* The back yard may be used wholly as a service area, its size will largely determine its use. Here may be the vegetable garden, the poultry yard, and stable. Shrubs, vines, and trees can be planted where they are not in the way and where they serve as a screen for the things that are less beautiful. A good arrangement is to leave the part of the back yard next to the house in open lawn bordered by low shrubs. The rear of the back yard may be bordered by evergreen trees, cedar, magnolia, etc.

b. *The Boundaries Enclosing the Open Areas.* These unite to form a good continuous horizon and are of three kinds:

1. *Good,* i. e. sightly views to be kept and framed in as outlooks, usually from the private, i. e. the living room area. These outlooks may be of two kinds, (a) off the property, and (b) on the property.

2. *Bad,* i. e. unsightly objects to be screened out from all points of view.

3. *Indifferent,* i. e. neutral, neither good nor bad, but usually making up the largest of the enclosing boundaries. They, therefore, become an important feature in the outlook and generally speaking a home needs this preponderance of neutral background to give it a quiet, restful setting.

The first consideration in the planning of the home grounds, then, is a general arrangement with reference to the location of the house, the plan for the open areas, and for the preponderance of the neutral background in the enclosing boundaries. All later developments depend upon this first broad treatment which at least gives privacy, quietude and background.

The second consideration deals with the essential features with regard to the arrangement that produces a good appearance. These essentials are:

A The buildings, by means of good architecture, low setting, and proper disposal.

B. The walks and driveways, by graceful line and by the manner in which they cut the land.

C. The open lawn areas by good form produced through the planting about their borders.

The third consideration is to establish a balance of interest both about the house and in the enclosing boundaries. Conflict may be prevented by observing the following principles:

A. The house should have a preponderance of neutral background.

B. Views should have an open foreground.

C. A garden should be enclosed and have ample neutral background.

D. Other points of interest should be developed in the enclosing boundaries.

E. These borders should be maintained as neutral mass by keeping the planting largely of trees and shrubs which are not conspicuous but which show simply normal form and green foliage. In this way there will be secured a proper background, not only for the house but for views off the property and for outdoor scenes or displays on the property whether of architectural design or of show plants or flowers in the border.

Finally, it should be clearly conceived that a private property is essentially a problem in obtaining privacy, and producing internal interest and apparent size. These may be secured by observing the following fundamentals:

A'. Keep the lawn spaces open to secure the greatest unbroken area.

B. Preserve the largest view on the property.

C. Make the open spaces assume more or less regular form by making the lines which mark the divisions of the land such as walks, walls, arbors, or shrub plantings, more or less parallel to the boundaries. Even the fundamental lines of the lawn areas will be regular, although their boundaries will be softened by undulating borders which vary the depth of planting at different points, particularly the corners.

The purpose of the foregoing is to state briefly the general principles upon which depends the making of a real modern home. A piece of ground with a house on it is not a home, however valuable the land or costly the house, although the first requisite is land and house. These may cost so little that they are within the reach of almost any one. There is little relation between costliness and attractiveness in a home. A neat appearance is always preferable to costly adornment.

We are apt to undervalue pleasant and inviting home surroundings as a background for family life. An ideal home is the first fundamental of ideal living. The greatest value of flowers, shrubs, and trees cannot be measured in dollars. To live long with them is the only way to realize this value. Restful, pleasing, effective plantings of the home make up the most substantial factor in a good environment for young people.

The familiar quotation, "Show me the garden a man has made, and I will tell you his character," should not be taken lightly. One has said that a home with pleasing and effective plantings creates a warm feeling for the occupants. Then it may be said that the house and yard are an index to the character of the family.

A knowledge of how to plant is necessary. What to plant and where to plant is more important, but still more important is the spirit of planting and giving "loving care."

When we are considering what and where to plant in the front yard we must think of the house and yard as a whole. One looking from off the property must see it as a whole. When seen in this way it must be pleasing, effective. If it looks

good it is good. If it pleases most people of cultivated taste it is the best.

The main planting should consist of trees and shrubs. Trees should have first consideration. A combination of deciduous and evergreen trees is desirable. Tall evergreen trees near the house are objectionable. A combination of trees and shrubs judiciously arranged on the border lines produces good effect.

Shrubs should be placed on the border lines in mass planting rather than in rows, and at the corners of the house or on the slopes of a terrace.

The selection of trees and shrubs will depend upon the size of the property, the character of soil and climate and the individual taste. For the front yard, shrubbery should be selected with reference to foliage rather than bloom. Those kinds that make a good show all the year round are desirable. The best guide in selecting material for planting, besides actual experience, is a well illustrated catalogue of a reliable nursery man of one's own country.

A good way to learn how to arrange plantings is to study the detail of arrangement in those plantings that are the most pleasing to one. Study the character of the distribution of plants on the property of one that has a reputation for knowing the art.

Since a garden is a private place, it should not occupy the front yard, but should be placed on the side or back yard enclosed by shrubs. This makes it interesting to one within it and inviting to one seeing it from without. Flowers may be planted about the borders of a place, in the corners about the steps, against the foundation of the house and along the walk. Flowers show off best with a background of foliage. Trees and shrubs should be the main features even of a neat backyard. Flowers are thrown in as decorations, but the decorations should not be over gaudy.

The following from Viscountess Wolseley's *In a College Garden,* is a beautiful expression of some of the foregoing principles: "My garden lies upon a slope facing almost due south, and from the little paved walk that surrounds the house I look down upon terraces and over the roofs of pergolas that follow more or less from east to west the waving bend of the hillside. We are on the lower part of one of the highest beacons of the South Downs, which goes by the scriptural-sounding name, Mount Caburn. This great hill, standing some 500 feet above sea, gives shelter from all northerly blasts, and the only wind which works havoc amongst the flowers is the boisterous southwest, which sweeps round the corner of a more southerly range of downs and leaps across a wide valley of marsh land to the foot of the garden.

"Had I to choose once more a position for a garden, I should be in favor of one like this upon a steep hillside, because it is comparatively easy then to obtain variety and artistic effect. The view from the lowest ground looking upwards is totally different from what one looks down upon from a height, and consequently the unexpected has not to be created by means of innumerable mounds, archways, and enclosures, which, upon level ground,

have to be resorted to in order to avoid monotony.

"The windows of the house have a very far-reaching view, for upon one side through the trees can be seen flat green stretches of brook land, in which lie little secluded villages. . . .

"This is the country that birds seem to love. . . . .

"In front of the house, however, is the nicest view, for on the other side of a wide green valley is a beautiful long low line of down land, running east to west. It is never the same from one year's end to another, and whether it be when shadows chase across the rounded slopes some sunny April day or in the silent heat-wave of summer, when its greyness alone looks cool, or again when winter snows turn it into something surprisingly tall and white, there is always a secret to be disclosed, a fresh charm to be understood.

"But, you will say, it is the garden we have come to see, not the countryside; and yet in most cases, for preference both these should be somewhat commingled, especially where the house is only a very small and unpretentious one. Certain it is that if the lines of woodland or distant hills are seen from a house or garden these should be coinciding lines in the pleasure-ground. Nothing should clash or allow a feeling of discord to enter into the peace of a garden. Therefore, when I see my friends, those who are true lovers of nature, unconscious of pergolas and terraces, standing on the small oblong mown lawn below the house drinking in the beauty of the distant view I am happiest. Their faces assure me that human hands have not done injury, that one's small gardening efforts have not thrust themselves too obtrusively into the foreground of this beautiful, natural hillside picture. I feel too, then, that the main feature of the garden, a wide grass walk which goes down the center of it, with high broad banks of flowering shrubs and herbaceous plants upon either side, has found favor. It leads the eye straight from the windows of the house to the fields in the valley below."

Shall We Have Home Fruit Gardens in Florida?

E. B. O'Kelly, Atlantic Coast Line Railway, Jacksonville, Florida.

Upon receipt of notification from the secretary of my appointment as chairman of the committee on "Home Fruit Gardens,'" and offering, to no avail, all the excuses I could think of why I should not be named to head such an important committee, I began a diligent search for information as to what work the Society has already done on the important matter of getting home fruit gardens planted. I could find little in the printed records that had been done or said about this problem. Necessarily, and no doubt properly, the commercial aspect of the fruit growing industry has consumed the greater part of your time. The big commercial problems have been discussed and solved. The time required for the solution of these commercial problems has left too little time for the seemingly minor details of the home fruit and vegetable garden.

Florida, like a number of other States, has long been widely known for her special agricultural and horticultural crops. As we all know, North and West Florida have depended largely upon cotton as the money crop, while the central and southern parts of the State have devoted themselves to commercial fruit growing and trucking. This idea of specialization has been developed still further so that most all the large producing centers specialize on one or more crops. Soil, climate, labor, transportation and other factors have favored this specialty type of farming, which was necessary especially in its initial stages of development and still is to a certain extent, since the products of the farm and grove must be produced and shipped in quantity before the best market and transportation facilities can be secured.

These familiar facts are recalled, not as an apology for the present conditions, but rather as an explanation why more attention has not been given to gardens and the planting of fruit and nuts around the farm and home. We have been educated to farm on an extensive scale, to give our attention to those crops which require a big investment of money, time and effort, and when they are ready for the market sell for large sums of money, even though the net profits may be small. Because of this disposition of mind there has been a shameful failure to appreciate the economic value of gardens, family milk cows and many other details which help to make farm life pleasant and profitable.

Especially has the planting of fruits for home consumption been badly neglected. A most excellent work has been done by the various educational agencies

in the State by increasing the number of gardens and in teaching methods of canning, drying and preserving. It is natural that quicker and more visible results should be noted in the increased number of vegetable gardens than in fruit gardens. Where planting space is limited, as it usually is, especially in our towns and cities, vegetable gardens have been more popular because of the less space they occupy and the quicker returns secured.

There is not a farm in the State which should not have from a quarter acre to an acre or more of fruit and nuts along with the vegetable garden, and a very few town and city gardens where a few figs, peaches, strawberries, dewberries, blackberries and probably other fruits could not be planted in some vacant corner. Besides adding beauty to the place it could be made a source of much pleasure and of a reasonable profit.

We all like to boast of Florida's great climate and of the great variety of fruits, vegetables and crops of all kinds which we can grow here, yet it is unusual to see a can of Florida fruits or vegetables on our grocer's shelves. Instead, we allow our hotels and restaurants to serve us California peaches and pears and we even buy them and serve them on our own tables.

Why should more fruits be planted around the home? One of the first reasons is that we have a great variety of fruits such as peaches, plums, figs, scuppernongs, strawberries, blackberries, pears, Japanese persimmons, pomegranates, quinces, pecans and numerous varieties of citrus which grow and do well when properly planted and cared for. The health giving qualities of fresh ripe fruit have long been recognized and expounded by the foremost physicians of the world. "An apple a day keeps the doctor away," is but an axiomatic expression of the universally accepted medicinal value of fruit for the human race.

It is furthermore true that the only way to be assured of an abundant supply of fresh fruit at a reasonable price is to grow it on the place and if it is not grown we usually do not have it at all. I am sure we have all noticed the great dearth of many fruits in season on our local markets and especially in the smaller towns throughout the State. The peaches, plums, pears, etc., are shipped in from other states and if they are to be had at all they are sold at prices which make canning, preserving and drying prohibitory.

The European war and conditions growing out of it have taught us many lessons in economics. High living costs have made us appreciate the importance of utilizing our every resource to the best possible advantage. Many thousands of gardens have been planted on the farms and in the cities where none had ever been planted before. Some of these were planted because of an earnest desire to help increase food production and thereby contribute something material toward the solution of the food problem, but a majority of these gardeners have learned the economic value of a garden and will continue to grow one in future years. They have seen what wonderful results can be

secured from a little ground when intelligence is applied in its handling.

A more opportune time for encouraging the planting of fruit gardens could hardly be selected than now, because interest in the home garden movement has been aroused and is fresh in the minds of the people. Response to a broad general movement for planting fruit gardens should be liberal and your committee desires to suggest that this Society can make no mistake by encouraging the people of the State in the country, town and city to plant fruits more generously for home consumption and for the local markets.

The Home Fruit Garden, Varieties for the Different Sections, their Planting and Care

W. L. Floyd, College of Agriculture, Gainesville, Florida.

With the development of the State now taking place, the increase in production, the consequent increase in wealth, the larger proportion of residents who spend the year round here, and their desire to live economically, healthfully and contentedly it seems a fitting time to discuss the growing of fruits for home consumption.

Florida extends through so great a range of latitude, that it is not possible to suggest fruits adapted to the whole area, therefore the following divisions are made in order that more definite and satisfactory recommendations may be made.

Northwest section embracing all of western and northern Florida to the Suwannee river.

Northeast section extending from the Suwannee river eastward and southward to the southern boundaries of Levy, Marion, Putnam and St. John's counties.

South-central section, counties south of the above to the northern boundaries of Palm Beach and Lee counties.

South section, the counties of Palm Beach, Broward, Dade, Lee and Monroe.

In the northwestern section, the deciduous fruits should be given a prominent place. These may include the apple, peach, plum, pear, pecan, persimmon, fig, grape and pomegranate. The apple does better here than in the other sections, but not well enough even here to justify planting more than a few trees of such varieties as Jennings, Early Harvest and Red June. Peaches should be given a prominent place, such varieties as Carmen, Sneed and Glen, with perhaps a tree or two of Jewel for very early fruiting. Most of the varieties of plum, pear, persimmon, fig and pomegranate listed by the nurserymen of the State will do well here so there is abundant opportunity for choice in selecting. The Curtis pecan gives most general satisfaction, though it bears a nut not so large as the Frotscher, Stuart and Van Deman, which, however, are not so sure of producing regularly a good crop. Of the bunch grapes, the Delaware, Diamond and Niagara will probably prove most satisfactory, and any of the muscadine varieties.

In the northeast section leaving out apples, but bringing in the Satsuma orange, kumquats, and Duncan grapefruit and the loquat, changing the varieties of peaches to derivatives of the Honey and Peento such as Imperial, Jewel, Taber and Waldo, planting only the Celestial

and Brown Turkey fig, Excelsior, Terrell and McRea plum, other kinds and varieties as recommended for the northwest section would prove satisfactory.

In the south-central section more attention should be given to the evergreens, every desired variety of the different groups of citrus, especially such choice ones not much grown commercially as, Ruby Blood, and King oranges, and Villa Franca lemons. The guava should have a place here also. Of the deciduous, the Jewel, Miami and Red Ceylon peach, the Excelsior plum, and muscadine grape are desirable.

In the southern section, any desired variety of citrus and such tender sub-tropicals as guava, mango, avocado, papaya, tamarind, sapodilla and the annonas.

As to the size of this fruit garden, I will discuss how small rather than how large it may be. Where only a back yard area is available, perhaps only 40 by 50 feet, I urge that varieties be selected judiciously and planted in such an area. Trees may be headed back and kept smaller than standard for several years; by planting close to fences, and boundary lines, placing those that will do well in partially shaded places near to houses, walls and shade trees, more may be placed than one imagines at first.

Figs do well close to a house or with their roots running under a wood pile. Pecans, pears, loquats and tamarinds may be placed where shade is desired instead of the much used oak and china, thus securing both beauty and utility. In a region where the pecan grows particularly well, I observed a few days ago in passing a country place eight spreading china trees growing about the house with no sign of a fruit tree of any kind.

Grape vines may be trained on fences, screening their unsightliness and also producing fruit. Guava and pomegranate may fill in unattractive corners, thus rounding out and beautifying the place. These are merely suggestions, in many other ways can we beautify our home grounds and at the same time secure luscious fruit in season.

Many fail and become disheartened because of soil conditions. In the light sandy soil so abundant in Florida something must be done more than plant desirable varieties and tickle the earth with a hoe about them occasionally. As much decaying vegetable matter as possible should be gotten into the soil before planting. Well rotted barnyard manure, decayed leaves and stems, vegetable mold from the hammock are all good and should be used in large quantities during the year or more before planting and about the tree afterwards.

A good garden hose should be secured and water given when seasons of drought prevail. A spray pump should be provided and the simple rules for the use of Bordeaux mixture, the sulphur and arsenic preparations, tobacco extract and miscible oil learned and applied.

We cannot hope to grow satisfactory fruit without spraying. It is not necessary to know the entomological name of the insect, the botanical name of the fruit and the chemical names of the ingredients of the mixture to do effective spraying, but it is necessary to know the methods

of attack and the way the remedy acts, and apply the mixture with good judgment, at proper time and in a thorough manner.

All diseases and dead branches should be pruned out when discovered, and careful systematic pruning done, mainly during December or January, to shape the trees in attractive form and make them produce more bearing wood. It is wonderful how one can shape a tree to his will if he begins early and does it regularly with thought and care.

Chickens are desirable in the fruit garden, as they catch many of the insect pests, enjoy the shade and refuse fruit, enrich the soil by their droppings and help cultivate by their scratching. Root knot, which attacks a number of our fruit trees, may be kept down in part by the efforts of a flock of chickens under the trees.

In 1917 the University of Missouri Extension Department made an estimate of the yield and value of the fruit produced in ten orchards in ten different counties of the State. It was found that the cash value after deducting cost of production, averaged $261.21 per acre. It is possible to make this home fruit garden the most productive area on the place.

If one does not understand methods of propagation the most satisfactory way to get the trees desired is to purchase them from a reliable near-by nursery, the varieties obtained will thus be adapted to the locality. It adds much interest to propagate at least a part of one's trees, and there are bulletins and books easily obtainable, which will make comparatively plain the methods to be followed. A few desirable U. S. D. A. Farmers' Bulletins are:

FARMERS' BULLETINS U. S. D. A.

157—Propagation of Plants.

181—Pruning.

440—Spraying Peaches.

471—Grape Propagation, Pruning and Spraying.

482—Pear and How to Grow It.

631—Growing Peaches, Sites, Propagation, Etc.

632—Growing Peaches, Pruning, Etc.

633—Growing Peaches, Variety and Classification.

685—The Native Persimmon.

700—Pecan Culture.

709—Muscadine Grapes.

852—Home Canning of Fruit and Vegetables.

859—Home Preservation of Muscadine Grapes.

871—Fresh Fruit and Vegetables as Conservers of other Foods.

These may be obtained free from Secretary of Agriculture, Washington, D. C.

Some helpful books are:

1. Modern Propagation of Tree Fruits, by Brown. John Wiley & Sons, New York.

2. Beginner's Guide to Fruit Growing, by Waugh. Orange Judd Co., New York.

3. The Pruning Manual, by Bailey. Macmillan Co., New York.

4. Dwarf Fruits, by Waugh. Orange Judd Co., New York.

5. Citrus Fruits and Their Culture, by Hume.

6. Pecan Culture, by Hume. From the author, H. H. Hume, Glen St. Mary, Fla.

The list of available bulletins of the Florida Experiment Station should also be secured and all desirable ones asked for.

There is no expenditure of money and efforts that pay more handsome dividends in the way of health, comfort and profit about the home than a well selected and properly cared for home fruit garden.

Annual Reports

REPORT OF AUDITING COMMITTEE.

We, the undersigned, the Auditing Committee, have examined the accounts of the secretary and treasurer and find same to be correct in every respect.

Orlando, Fla., May 8, 1919.

S. F. POOLE, *Chairman*,
F. M. O'BYRNE.

REPORT OF SECRETARY.

Cash account to May 8, 1919:

RECEIPTS.		EXPENDITURES.	
Received from Treas. Hart for payment of bills	$ 141.08	36 bills totaling	$ 551.98
Receipts for membership dues, interest on bank deposits, and sales of back Proceedings	1,377.23	To Treasurer Hart	966.33
	$1,518.31	Total	$1,518.31

REPORT OF TREASURER.

RECEIPTS.			EXPENDITURES.		
1918			1918		
Apr. 25	To balance on hand	$ 616.17	Jan. 14	Stenographer's bill	$ 80.00
Nov. 4	Secretary Floyd	70.00	Aug. 14	Secretary's salary	100.00
Nov. 29	Interest from banks	4.33	Nov. 30	E. O. Painter Pub. Co.	440.50
1919			Dec. 8	E. O. Painter Pub. Co.	67.09
Mar. 18	Mrs. Temple's fee	1.00	1919		
Apr. 14	Secretary Floyd	100.00	May 7	Grower Pub. Co.	75.00
May 7	Secretary Floyd	966.33	May 7	Secretary Floyd	1.00
		$1,757.83	May 7	Balance in treasury	994.24
					$1,757.83

REPORT OF EXECUTIVE COMMITTEE MEETING, FEBRUARY 9, 1919

The Executive Committee of this Society held its annual spring meeting in Jacksonville on February 9, 1919. The meeting was called to order at 11:00 a. m. There were present Messrs. Hume, Hubbard, Rolfs and Floyd.

The secretary submitted a financial report for the period beginning April 25, 1918, and ending February 9, 1919, which showed $308.52 to have been received and $261.68 paid out, leaving a balance on hand of $46.84. He reported bills on hand and unpaid amounting to $49.55.

The secretary reported the total annual membership for 1918 to be 847. The number of life and honorary members was 124, making a total of 971 members for the year 1918. The membership campaign carried out by the Florida Grower Publishing Company secured 344 members for the Society. Many of these were non-residents and would probably not have been secured otherwise. Only 46 of those secured by them were members during 1917.

A motion was presented and adopted "that the Florida Grower Publishing Company is hereby authorized to continue during 1919 the combination offer of a membership in the Florida State Horticultural Society and a year's subscription to the Florida Grower under the same conditions as described in the resolution passed by the committee at its meeting on February 7th, 1918;" and "that the treasurer of this Society is hereby directed to pay seventy-five and no/100 dollars ($75.00) to the Florida Grower Publishing Company to cover cost of postage and stationery in connection with the advertising campaign for 1919."

A motion was presented and passed that the same size of page and the same general make-up be used in the future publications of this Society as used in the past publications, but that the size of type used be left optional.

The date for holding the annual meeting to be held at Orlando was discussed and set at May 6 to 9, 1919.

There being no further business, the meeting adjourned.

REPORT OF EXECUTIVE COMMITTEE MEETING, MAY 8, 1919.

At a meeting of the Executive Committee held in Orlando, May 8th, the following members were present: Messrs. Hart, Hubbard and Floyd, and Rolfs by proxy.

The minutes of the February meeting were read and approved. The secretary was instructed to secure bids and let contract for the publication of Numbers 3 and 4 of Volume 32, and Numbers 1 and 2 of Volume 33 of the Quarterly publication of the Society; the number of each issue to be 100 in excess of the actual membership of the Society at the time of going to press.

The secretary was instructed to proceed

with the publication of Number 4 of Volume 31 of the Quarterly and Numbers 1 and 2 of Volume 32; and to combine Numbers 1 and 2 of Volume 32 and issue the same as a Memorial Number. The chairman of the Committee on History and Necrology was requested to edit this number.

After a discussion of various matters in reference to the work of the Society, there being no further business, the committee adjourned.

REPORT OF MEMBERSHIP COMMITTEE.

We have been very successful this year in securing members, and I am pleased to say that the Society today has a larger membership than we have ever recorded before. So far, we have an annual membership for 1919, of 1,170. There will be others. I am sure Mr. Floyd will get quite a number at Gainesville, through the letters he has sent out. We sent out 5,000 through the Grower, and Mr. Floyd sent out several thousand. While we have a larger membership today than we have ever recorded before, we haven't half what we should have. The Florida State Horticultural Society should have a membership of at least 5,000, and if everybody here would do their part we would have 5,000. The committee can't do it alone. I want everybody to pledge to support the Membership Committee, and see that we get our 5,000. We are entitled to it.

RUSSELL KAY,
Chairman.

Mr. ———: Accepting this report of the Membership Committee, I suggest that we keep Little Jeff on the job, because I believe he will deliver the goods and get us 5,000 members.

It was moved and seconded that Little Jeff stay on the job. Carried.

REPORT OF COMMITTEE ON HISTORY AND NECROLOGY.

During the past year the grim reaper has exacted a heavier toll from the Society than in any other year since its organization. This applies not only to the large number of deaths, but to the prominence horticulturally of those lost. Fifteen deaths have been reported to the committee, as follows: Mrs. E. S. Hubbard, Mrs. Okle Painter Williams, Mrs. Potter Palmer, Mrs. A. B. O'Hara, E. W. Barkwell, M. B. Carson, A. M. Gardner, O. W. Conner, Dr. J. F. Corrigan, A. D. Cunningham, Elford Dickerman, Alexander Finlay, R. D. Hoyt, K. B. Kepler and J. A. Stevens. Fitting mention will be made in the Proceedings publication or possibly in a special memorial number.

Two valuable additions to the historical files have been made in the form of papers written by M. S. Moremen and F. G. Sampson, and miscellaneous notes of interest contributed by the late J. A. Stevens and the late R. D. Hoyt and

others. Mr. Sampson's paper is of great interest, as it contains an account of his experience in lemon growing. Thus we have permanently recorded a record of probably the largest lemon grove in the State. It becomes apparent on reading, that the lemon was not a failure in Florida, as some people think, but that other circumstances forced Mr. Sampson to abandon his Bayview venture. He still has faith in the lemon in Florida.

The committee regrets that so many of the fine old pioneers of the industry are so exceedingly reticent. When asked to write a paper they almost invariably deprecate their experiences and while wishing the committee well and lauding its purposes, they protest that they have had no experiences worth recounting, and refer us to others. Some promise to help us out, but postpone the matter from time to time till finally they hear the Voice and it is too late.

We feel that we have added valuable material during the past year, but there is still a tremendous store of information which is as yet untouched. Will not others of the older growers come to our aid, contributing pages from their book of experience for this committee to record for the use of future generations?

F. M. O'BYRNE,
Chairman.

Election of Officers

On Thursday evening, May 5, 1919, the following officers were elected for the year beginning January 1, 1920, and continuing to and including December 31, 1920:

PRESIDENT—H. Harold Hume, Glen St. Mary.

FIRST VICE-PRESIDENT—L. B. Skinner, Dunedin.

SECOND VICE-PRESIDENT—S. F. Poole, Winter Haven.

THIRD VICE-PRESIDENT—W. J. Krome, Homestead.

SECRETARY—Bayard F. Floyd, Gainesville.

TREASURER—W. S. Hart, Hawks Park.

EXECUTIVE COMMITTEE—P. H. Rolfs, Gainesville; E. S. Hubbard, Federal Point; L. D. Niles, Lucerne Park.

Selection of Next Meeting Place

At the evening session on May 8, 1919, Ocala was selected as the meeting place for the Thirty-third Annual Session of the Society in 1920. Invitations were received from Lakeland, Daytona, Miami and St. Petersburg. A spirited contest was conducted by representatives from Ocala, Lakeland and Daytona. A pretty speech by Mrs. Caroline Moorehead drew the sympathy of the audience and resulted in the selection of Ocala.

Resolutions

Adopted by The Florida State Horticultural Society While in Session at Orlando, from May 6 to 9, 1919.

The following resolution was adopted and ordered to be wired to the Speaker of the House of Representatives, and to the President of the Senate, at Tallahassee, with the request that it be read to these bodies at the proper time.

Whereas, The citrus industry is again threatened with disaster in the event that the Plant Board is without funds with which to continue the work of inspection for citrus canker, and

Whereas, Senate Bill No. 183 and House Bill No. 404 are now pending, looking to the appropriation of $250,000, to be divided as follows: citrus canker inspection, $130,000; quarantine inspection, $50,000; sweet potato weevil, $30.-000, nursery inspection, $40,000; making a total of $250,000, which total sum is to be used to further prosecute the great work which the Plant Board has so well in hand; and

Whereas, In an address delivered before the State Horticultural Society on Tuesday evening, May 6th, Prof. W. T. Swingle, government expert in charge of citrus work in the Orient, states that in China, Japan and the Philippines the round oranges are doomed; that the citrus canker is beyond control and only oranges of the tangerine family can now be grown, as they seem to be semi-resistant; therefore be it

Resolved, That the Florida State Horticultural Society, now in session in Orlando, Florida, hereby most enthusiastically and unqualifiedly endorses Senate Bill No. 183 and House Bill No. 404; and in view of the fact that horticulture and agriculture are the leading industries of the state, paying as they do a large proportion of the taxes; and in view of the prospective appalling loss, not only to the individual growers, but to the state at large, we, as a society representing over one thousand horticulturists and agriculturists, appeal to our senators and members of the legislature, not only to vote for the passage of this bill, but to give it their hearty, unqualified support.

Resolved, That we, as members of the Florida State Horticultural Society, express our gratitude to our president, Mr. H. Harold Hume, for his unselfish fight in our behalf, for his invaluable services in behalf of the appropriation for the elimination of citrus canker, and to all those who have worked so faithfully and untiringly for the passage of the appropriation.

Whereas, The labor situation, as affecting the agricultural and horticultural interests of the State of Florida, has been and is critical, and on account of the fact that, owing to the geographical location of the state, the labor supply available for these industries is only affected to a limited extent by the conditions of labor supply in other parts of the United States, and

Whereas, A considerable proportion of the farming and fruit-raising section of this state has to depend almost wholly upon the Bahama Islands and the West Indies for its supply of common labor, and any Federal legislation restricting immigration into the United States from these Islands would be almost ruinous to the interests named, therefore be it

Resolved, That this society earnestly appeals to the members of Congress from this State to use their every effort to protect the interests represented by its members, by keeping open free immigration from the Bahama Islands and the West Indies, safeguarded only by such restrictions as may be deemed absolutely essential for the general welfare; and further be it

Resolved, That the secretary of this society be directed to send copies of this resolution to each of the United States senators and representatives from this state, and to Mr. J. O. Traxler, Farm Help Specialist of the United States Department of Agriculture, Gainesville, Florida.

Whereas, The attention of this organization, the Florida State Horticultural Society, and its various members, has been directed on numerous occasions to the evidences of the efforts of the Federal Horticultural Board of the United States Department of Agriculture to protect the horticultural and agricultural interests of the United States from injury and possible disaster through introduction from foreign countries of insect pests and diseases of plants and plant products, and

Whereas, These efforts have, in our judgment, been accompanied by most excellent results, particularly here in Florida where the Horticultural Board and the State Plant Board of Florida have been co-operating so earnestly and successfully in keeping out of the state many insects, diseases and pests to which our varied, highly developed and extensive fruit industry is exposed, and

Whereas, Our attention has also been called to the fact that certain opposition has arisen to the provisions of the quarantine regulations of the Federal Horticultural Board regarding the importation of nursery stock, etc., from foreign countries, as contained in notice of quarantine No. 37, the provisions of which are, in our opinion, necessary to the continued welfare and prosperity of the horticultural and agricultural interests of this country, now, therefore, be it

Resolved, That this society, in annual session at Orlando, Florida, this 8th day of May, 1919, places itself on record as heartily supporting the Federal Horticultural Board in its protective measures as incorporated in quarantine No. 37 and amendments thereto, and pledges the sup-

port of its members; that as a mark of appreciation, copies of this resolution be forwarded to the Hon. David F. Houston, Secretary of Agriculture, and to the Secretary of the Federal Horticultural Board; further, that the secretary of this society write to Mr. C. L. Marlatt, chairman of the Federal Horticultural Board, conveying to him our thanks for the unremitting, unflagging, and tireless energy he has exerted, and the interest he has displayed for so many years in securing and enforcing plant quarantine legislation, and further, that Mr. Marlatt be requested to convey to his fellow-members of the board this expression of our good will, co-operation, interest and appreciation in and for the splendid work the Federal Horticultural Board is performing.

Whereas, Our society looks upon its visit to Orlando with unalloyed pleasure, and must regard this present session as memorable for the facilities placed at its disposal, and the warm hospitality shown by the people of Orlando and Orange county, therefore be it

Resolved, That the Florida State Horticultural Society express to the people of Orlando and Orange county, to the city government of the City of Orlando, to the membership of the Orlando Board of Trade, to the Orlando newspapers, to Mr. H. M. Voorhis, to Mrs. John Caruthers, Mr. F. W. Fletcher, Mr. W. H. Brokaw, Mr. Theodore L. Meade, Mr. Walter Drennon, to the Orlando quartet, and to any and all others who have contributed to the pleasure of this visit to this most beautiful and progressive city, its unqualified appreciation and sincerest thanks for the hospitable and friendly aid extended to our membership. Orlando, itself, is an inspiration to further progress in Florida. The beauty of its cathedral arches of sturdy oak trees, and magnificent vistas of lakes and groves make an impression which is only to be exceeded by that left by the artistic and substantial nature of its civic improvements, and the progressive modernity of its business enterprises. These are things which naturally lead to the expectation of finding the people of this vicinity precisely the sort of substantial, progressive, loyal and enterprising citizens they are known to be. Their wholesome co-operation has aided in making this meeting profitable and helpful to our society in many ways, therefore be it further

Resolved, That this society further impose upon the kindness of the Orlando newspapers, and request the publication of this resolution in order that each resident of the community may be apprised of our appreciation for the kindnesses shown us.